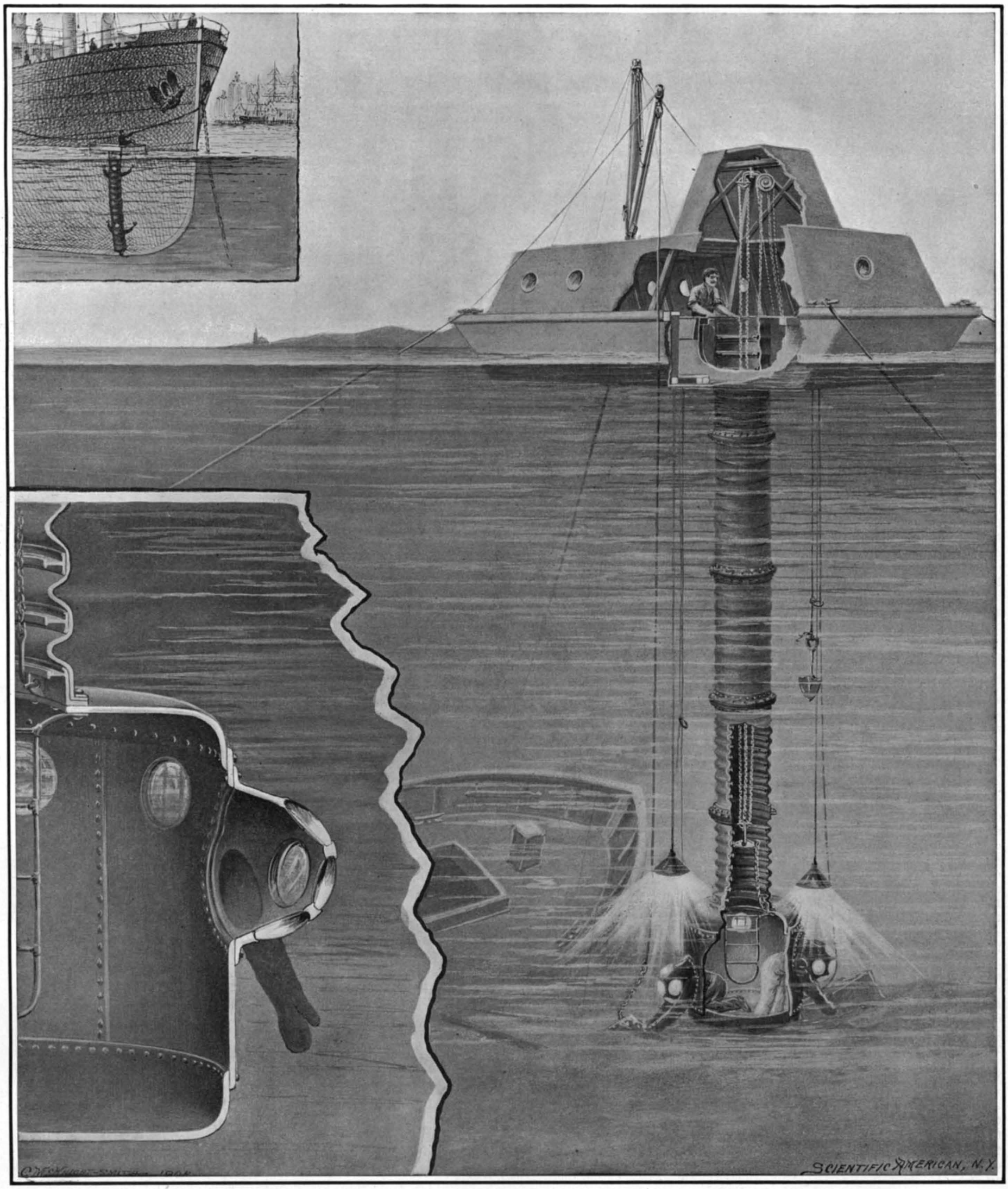
SCIENTIFIC AMERICAN

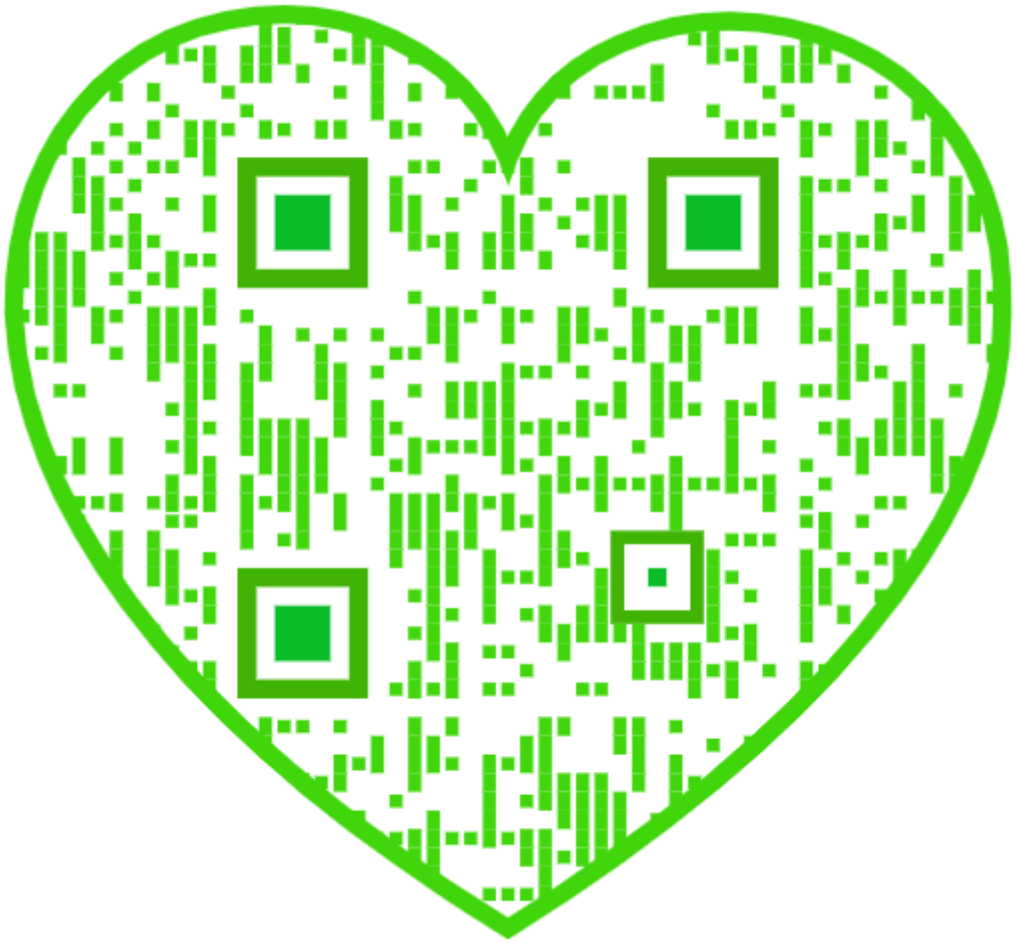
[Entered at the Post Office of New York, N. Y., as Second Class Matter.] Copyright, 1908, by Munn & Co.

Vol. XCVIII.—No. 14. ESTABLISHED 1845. NEW YORK, APRIL 4, 1908. 10 CENTS A COPY $3.00 A YEAR.



A Submerged Operating Chamber Fitted with Helmets and Flexible Arm Sleeves is in Free Communication with the Surface Through a Collapsible Vertical Shaft.

A NEW APPARATUS FOR SUBMARINE OPERATIONS.—[See page 248.]



SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO. - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

CHARLES ALLEN MUNN, *President*
361 Broadway, New York

FREDERICK CONVERSE BEACH, *Sec'y and Treas.*
361 Broadway, New York

TERMS TO SUBSCRIBERS.

One copy, one year, for the United States or Mexico $3.00
One copy, one year, for Canada 3.75
One copy, one year, to any foreign country, postage prepaid, 18s. 6d. 4.50

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (established 1845) ..... $3.00 a year
Scientific American Supplement (established 1876) ..... 5.00 "
American Homes and Gardens ..... 3.00 "
Scientific American Expor Edition (established 1878). ..... 3.00 "

The combined subscription rates and rates to foreign coun ries, including Canada, will be furnished upon application.

Remit by pos al or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, APRIL 4, 1908.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE PERIL OF THE TURNSTILE DOOR.

It is surprising that the turnstile door has not long ago aroused a strong protest, on the ground that it constitutes a menace to public safety. We say this with due appreciation of the ingenuity of this device, and the success with which it accomplishes its desired end of preventing the inrush of cold air which accompanies the opening and shutting of doors of the ordinary hinged type.

The object of the turnstile door is to provide an intermittently obstructed passageway between the interior and the exterior of a building, and it certainly fulfills its end only too well. The peril of this device lies in the fact that, in so successfully shutting the cold air out, it effectually shuts the occupants of the building in. The drafty effects of the ordinary door are avoided by permitting only small pockets of air to enter in slow succession; and the menace of the door lies in the fact that people can pass through this same exit in these same rotating pockets only one at a time. It is true that the leaves of the revolving door are arranged to fold together, thereby allowing two persons to pass the door abreast; but in the event of panic, the jam might be too great to permit the folding of the leaves. Moreover, the doors, even in the folded condition, present at best but a narrow passageway. We have in mind, as we write, a certain hotel, recently opened in this city (and this is merely a typical case among many); in which the only exit to the street in case of fire would be through one of these doors. Here, in the event of any accident that would cause a rush for the door, two things are certain: first, that even if the utmost order prevailed, it would take an interminable time for the population of the hotel to file out through the one door; and, secondly, that in the almost certain event of panic, the door might become jammed, and the one means of exit to the street be most effectually blocked up. Furthermore, if a turnstile door was once jammed by the congestion of a crowd of frantic people, it would be an exceedingly difficult obstacle to break down or clear away; for these doors usually revolve in solid masonry or substantial steelwork.

We are strongly of the opinion that the use of this device should be made subject to the permit and oversight of the proper city department, whether that of Building or Fire. Otherwise, it is only a question of time when the turnstile door may have to answer for a tragedy of proportions that one does not care to contemplate. Should the authorities decide to take this matter up, as they certainly should at once, we would suggest that the use of these doors be prohibited, except in cases where they are flanked by hinged doors, opening outwardly to the street and capable of being quickly released.

THE SENATE HEARING ON THE ALLEGED DEFECTS OF OUR NAVY.

The Senate hearing on the alleged defects in the vessels of our navy was held with a view of ascertaining the exact facts regarding the freeboard, position of waterline armor, height of guns, and other features of our battleships as compared with those of the leading foreign navies. The proceedings were very exhaustive, and resulted in the presentation of a vast amount of information, accompanied with detailed plans bearing upon these important points. The people of the United States will be gratified to learn that the evidence which has thus far transpired, is not only a complete vindication of the excellence of the ships of our navy, *but it proves them to be, in some respects, decidedly superior to foreign ships of the same date and type.*

It was evident from the testimony given by certain seagoing officers who have been active in criticism of our ships, that they indorsed the allegations made in what is known as the Reuterdahl article. Now, the charge made in that article (and it is well to be perfectly clear on this point) was not so much that our ships could be made better than they are (a fact which everybody is prepared to admit), *but that our ships are inferior, and greatly inferior, to the ships of foreign navies.* It is with this last statement in particular that we have always taken decided issue. *The* SCIENTIFIC AMERICAN *claims (and not a word of truth has been adduced to show the contrary) that our battleships of any given type and date are as efficient as foreign battleships of the same type and date, and, in respect of their armament, are greatly superior.*

The official cross sections of a large number of typical foreign battleships, which were presented in the recent Senate hearing, prove that this contention is absolutely correct. Compared with the British and Japanese ships, our armor belts are as thick, and sometimes thicker; they are in the same position with regard to the waterline; our freeboard is as great, and in some cases greater; our broadside guns are carried as high, and generally higher; our rate of ammunition supply is as rapid, and in many ships more rapid; and (greatest surprise of all) the open ammunition hoist to the turrets is not peculiar to our own navy, but is found in several of the crack battleships and cruisers of other navies.

That the above comparison is a high testimony to the quality of our ships will be recognized, when we mention that the cross sections cited are of such ships as the British "Royal Sovereign," "Majestic," "King Edward," and "Dreadnought," and the Japanese "Asahi," "Mikasa," "Kashima," and "Aki"; and we may mention just here that even in the case of the two crack battleships "Mikasa" and "Asahi" of the Japanese fleet, the broadside guns are only about 12 feet above the waterline, as against from 14¾ to 15¼ feet on our own ships. So also in the comparison with contemporaneous French ships, it is found that the thickness and position of our armor belts is fully as satisfactory; that the armoring of the topsides is greatly superior, and that in respect of the freeboard only, and the height at which the guns are carried, have the French ships any so-called advantage. That lofty guns and towering topsides have been adopted at the expense of stability is shown by the fact that, with one exception, the French-type Russian battleships which fought in the battle of the Sea of Japan proved their topheaviness by turning turtle and going to the bottom. Furthermore, the one French-type ship, the "Orel," which was captured by the Japanese, was changed by them to the American type, by cutting down her decks and lowering her gun positions, as is clearly shown in the illustrations on page 241 of this issue.

According to press dispatches, Rear-Admiral Evans has sent to the Department a report upon the behavior of our ships during the Pacific cruise, in which certain suggestions are made with reference to the questions of armor belts, turrets, freeboard, etc., which are now in debate. The report contains the opinion of a naval constructor, detailed especially to watch the behavior of the vessels, and of various seagoing officers in charge of the ships. In due course, when this report becomes available, we hope to give a review of its salient features. According to press dispatches, Naval Constructor Robinson noted that, although, in the main, the voyage was made in quiet weather, the ships, at times, rolled sufficiently *to expose the unarmored bottom below the belt*, and hence the suggestion of some of the officers that the belt be made wider *is accompanied with the stipulation that the bottom of the belt be left in its present low position.* It is suggested that the additional weight due to wider belts be compensated for by the removal of "what is termed superfluous weight." We believe that no small reduction of weight can be made in this way; for it is a notorious fact that our ships carry, in the way of comforts and conveniences for officers and men, much weight that is not to be found in foreign battleships. It is also stated that Rear-Admiral Evans "recommends taking off the after bridges"; though why he should do this, when it was at his earnest insistence, and in opposition to the strong wish of the Construction Department, that an extra flying bridge was built aft on the "Connecticut" for his special use, we are at a loss to understand. Commenting on the suggestion of some of the commanding officers that the belts might be raised from 6 inches to a foot higher (which, by the way, would bring them just where they were designed to be before extra weights were added during construction) Admiral Evans says:

"But even this is open to question, for it has been noted that even when heavily laden and in the smooth to moderate seas, which have thus far characterized this cruise, the ships frequently expose their entire belt and the bottom plating beneath.

"It must be remembered that even a 5- or a 6-inch shell, of which there would be a great number, could inflict a severe and dangerous injury if it struck below the belt, while otherwise the waterline, even with the belt entirely submerged, is, on account of the casemate armor and coal, immune to all except the heaviest projectiles.

"The fact is that under the sea conditions in which battles may be fought a belt of 8 feet in width, if considered alone, is too narrow to afford the desired protection wherever it may be placed, and the question becomes an academic discussion with certain arguments on each side.

"It is understood that on the latest ships this question is of little import, as the citadel armor is but 1 inch less in thickness than on the waterline, and for those ships already built it is believed that when the bridges are removed and all weights, which would be landed should war break out, are taken into consideration, the ship will rise to the 6 to 12 inches, which is believed to be the maximum that it could be desired to raise them."

If, as is reported, the Admiral states that the broadside guns "can only be used to advantage when the battleships are not steaming more than 10 knots," we can only say that bad, indeed, must be the case of the battleships of other navies, the majority of which carry these guns from one to three feet nearer the water than do our own ships.

The country is to be congratulated on the fact that the recent wild and baseless criticism of our ships should have been made just when the fleet was starting for the Pacific. In spite of the fact that most of it was either false or grossly exaggerated, it has done an incalculable amount of good; for as a result of the discussion and investigation which has followed, a large amount of information has been made public regarding our ships, which scarcely could have become known in any other way. Not only have they now a more intelligent knowledge of our navy, but the confidence of the people of the United States in the excellence of our ships has been greatly strengthened. As a further indorsement, there has come the brilliant success achieved by Admiral Evans and his officers and men, in bringing that fleet through its 14,000-mile trip, in perfect order and two days ahead of the schedule time.

GOVERNMENT AID IN THE DEVELOPMENT OF AERONAUTICS.

It is a matter of profound regret to the SCIENTIFIC AMERICAN that the Military Committee of the House should have voted against the presentation of the bill appropriating $200,000 for the development of military aeronautics. We believe that the time is fully ripe for substantial government recognition of this subject; and this for the two weighty reasons: first, that the three leading powers of the world—France, Germany, and Great Britain—have given official recognition to the airship, and, secondly, that the *private* enterprise of American inventors and experimentalists has carried the development of the aeroplane to a point which has placed America far in the lead among the nations of the earth. We are not unmindful of the fact that, in tardy response to the earnest representations of the Signal Corps, the government last summer officially recognized the new science to the extent of authorizing the formation of an aeronautic corps; but unfortunately, no provision whatever was made to supply the new venture with the funds which are absolutely necessary to enable it to do effective work. France, Germany, England, and other foreign governments formed similar aeronautical corps some time ago; and substantial funds were provided for the purchase of machines and apparatus and the prosecution of experimental work. In view of the importance which military ballooning and aeronautics in general have assumed in foreign countries, the sum of $200,000 asked in the bill under consideration is not excessive; particularly when we bear in mind that experimental work in aeronautics is necessarily of a costly character.

It cannot be denied that the results already achieved in the navigation of the air are such as to fully warrant such a modest expenditure as is now asked of Congress to render the work of the aeronautical corps effective. The achievements of the past, whether accomplished with the simple spherical balloon, with the dirigible, or with the aeroplane, are of such a practical character, and are fraught with so much promise for the future, that the government which shuts its eyes to the facts, and deliberately refuses to give financial assistance for the development of aeronautics, lays itself open to the charge of being either dilatory or shortsighted. Nearly forty years ago, during the siege of Paris, no less than sixty-five balloons were constructed; and out of the sixty-five aeronauts who made ascents, only about five had been up before. Very significant, also, is the fact that only two of these aeronauts were lost, and only five were made prisoners by the Germans. According to that practical aeronaut, Auguste E. Gaudron, these sixty-five balloons are said

to have carried 164 passengers, and 12½ tons of postal material, representing no less than 2,500,000 letters. Three hundred and eighty-one carrier pigeons, which were taken up in the balloons, carried about 100,000 messages and telegrams. The receipts from letters and telegrams were about $200,000; the expenses of making and running the balloons, and the cost of the gas for inflation, came to a total of about $58,500, which left a margin of profit of $141,500. This was thirty-eight years ago; and the improvements which have been made in the interval in the materials and method of manufacture, to say nothing of the cumulative experience which has been gathered, show that the simple balloon is something more than an expensive hobby; that it has a practical commercial value; and that in the military operations of the future, its use must figure very largely. The balloon races and long-distance trips in Europe and in this country, where continuous flights of from 872¼ to 1,193 miles have been successfully accomplished, are indicative of the great advance which has been made in the art, particularly in the past ten or fifteen years.

The development of the dirigible balloon since the memorable day in 1901 when Santos-Dumont circled the Eiffel Tower, has been truly remarkable, especially if we bear in mind the inherent difficulties of the problem of controlled air navigation. "La Patrie," the lost Lebaudy airship, was probably the most successful dirigible ever built. It was estimated to have made more than 300 voyages, returning successfully each time to the starting point. Its greatest performance was the 146-mile flight from Paris to Verdun, which was made without a stop on November 23 last, at an average speed of 21.19 miles an hour. This airship proved its ability to contend with a fairly brisk wind, and at times it carried as many as seven passengers. Rivaling "La Patrie" in its performance, is the large 420-foot dirigible of Count von Zeppelin, which is credited with a lifting capacity of fully three tons dead weight. Although it has not made so many flights as the French airship, it is credited with having remained in the air continuously for eight hours, and with having made a flight of 211 miles. Both theory and practice point to the advantages to be gained from large size in the construction and operation of dirigibles, and there is no reason either theoretical or constructional, why, if a dirigible be built of great size and sufficiently light and strong materials, it should not be capable of making speeds of from 40 to 45 miles an hour, and of carrying a considerable number of passengers or several tons of freight. We confidently believe that, if a large dirigible were constructed with a strict view to such a combination of lightness and strength as enabled Mr. Herreshoff to produce the yachts "Defender" and "Reliance," it would be possible to produce a machine which would be capable of making its desired destination with a considerable degree of independence of wind and weather conditions.

In coming to the third type, the aeroplane, or heavier-than-air machine, it is surely sufficient to refer to the marvelous success obtained two and a half years ago by the Wright brothers, when they made a continuous flight of 24 miles at an average speed of nearly 40 miles an hour. This flight is rendered the more remarkable, when we bear in mind that the machine was flying over a rectangular course, in which corners had to be turned, and that it was maintained at a predetermined height above the ground, which varied according to the obstacles, in the way of trees, etc., that had to be cleared. The SCIENTIFIC AMERICAN made careful investigation of the facts concerning this flight, and they were found to be such as to establish its authenticity beyond all question. Although the recent flights made by Farman in France are modest in comparison with the flight of the Wright brothers, they have served to establish still further the practicability of the heavier-than-air machine.

We understand that an effort is to be made before the Senate Committee to secure restoration of the appropriation of $200,000, and that General Allen, on behalf of the Signal Corps, will make a strong argument for the granting of the financial assistance for carrying on the necessary experimental work. At the present time the aeronautical corps owns a couple of balloons, and it has installed at Fort Omaha, Neb., a complete electrolytic gas plant for the manufacture of pure hydrogen. If the Senate should make the necessary appropriation, it will be possible to purchase a large military dirigible balloon for experimental work, and also one or two aeroplanes or other types of heavier-than-air machines. It would be difficult to find a field for experimental work which is more inviting than that of aeronautics; and with the proper government backing, the trained officers of our Signal Corps, who for years have been seeking for such an opportunity as the present bill will give them, would be enabled to prosecute some greatly-needed investigations as to the best types of propellers; the proper form, number, and relative positions of the aeroplanes; the most effective position for the vertical and horizontal rudders; and, most important of all, the best devices for securing automatic adjustment of equilibrium.

SCIENTISTS AT PLAY.

BY HERBERT W. HORWILL.

There are few more interesting works of reference than the biographical dictionaries that are published in various countries under the title of "Who's Who." The London publication of this name makes one concession to the curiosity of human nature in which its example has not yet been followed by its American contemporary. It records, wherever the information can be obtained, not only the professional pursuits and achievements, but also the "recreations" of the men who find a place in its list.

In our attempt to find what British men of science do with their leisure, let us turn first to the astronomers. The Astronomer Royal, Sir William Christie, leaves his "recreation" line blank, as does also Prof. H. H. Turner. Sir Robert Ball finds relief from the severity of his studies in golf and cruising, Sir Norman Lockyer in tennis and golf, Sir George Darwin in tennis and cycling, and Sir David Gill in golf, shooting, and fishing. Sir William Huggins's list is a longer one, including the collection of antique works of art, music, botany, and fishing.

In the geological section Sir Archibald Geikie makes no report, but his brother, Prof. James Geikie, sets down golf, cycling, and travel. Travel is also the diversion of Prof. W. J. Sollas. Prof. Boyd Dawkins favors fishing and gardening, and Prof. C. Lapworth field geology and golf. Prof. J. Milne, the seismologist, leaves us guessing, for he will not gratify our curiosity any further than by stating that his recreations are "various."

Dr. Alfred Russel Wallace, the veteran biologist, is the only British man of science we have discovered who confesses to a predilection for chess. He acknowledges a love for gardening as well. Sir J. D. Hooker gives "natural science" as his chief recreation, adding to it the collection of Wedgwood ware, chiefly the portraits of eminent men. Prof. F. W. Oliver mentions mountain climbing and natural history; Dr. D. H. Scott, walking and fishing; Prof. J. N. Langley, skating, gardening, and golf; Dr. Archdall Reid, cycling, swimming, and cards; Prof. E. A. Minchin, swimming, boating, and the study of natural history; Dr. S. F. Harmer, cycling; Dr. W. H. Dallinger, nature study, travel, and cycling; and Prof. W. A. Herdman, yachting, cycling, walking, and early archæology. Sir Edwin Ray Lankester is content with golf, thus contrasting notably with Prof. E. B. Poulton, who avails himself of the opportunities afforded him by golf, lawn tennis, croquet, cycling, squash rackets, swimming, gardening, carpentering, and various building operations. Lord Avebury (Sir John Lubbock) and the Hon. Lionel Rothschild, though they have made valuable contributions to knowledge, can scarcely, perhaps, be reckoned as men of science by profession. The former gives his recreations as natural history and traveling, and the latter as the study of zoology, shooting, and hunting.

A few of the most eminent chemists make no confession of their weaknesses. Sir William Ramsay refreshes himself with languages and cycling; Prof. G. D. Liveing with field geology and gardening; Dr. Percy F. Frankland with riding, traveling, and gardening; Prof. Raphael Meldola with field natural history and photography; Prof. H. B. Dixon with football—he played on the Oxford University team—cricket, cycling, and climbing; Prof. F. Soddy with travel and climbing; Prof. A. Smithells with golf; and Prof. W. A. Bone with cricket, tennis, and music. Sir John Brunner finds relaxation in golf, and his partner, Dr. Ludwig Mond, in the collection of works of art, chiefly of the early Italian school of painting.

The mathematicians and physicists appear on the whole to be a sober and serious band. Many of them record no recreation at all. Sir Oliver Lodge is among this number, but he gives himself away in another section of his biography. For how can we accept your repudiation of the lighter side of life, Sir Oliver, when you admit that you are member of two golf clubs? Prof. J. J. Thomson is fond of tennis and golf; Prof. Arthur Schuster of motoring and sketching; Prof. H. L. Callender of shooting, motoring, and tennis; and Dr. R. T. Glazebrook of golf, rowing, mountaineering, and cycling. Prof. Karl Pearson devotes his leisure to antiquarian studies in genealogy and folk custom. Of the electricians, Dr. J. A. Fleming pursues photography, travel, and experimental research; Prof. J. A. Ewing, climbing and photography; and Sir William Preece, yachting and shooting. Prof. W. E. Ayrton leaves this entry blank, but Mrs. Ayrton, who has proved herself so successful a companion in his investigations, confesses to finding refreshment in novel reading and sketching. The engineers show considerable diversity. Sir John Wolfe Barry's recreations are riding and fishing; Sir Alex. Kennedy's music, mountaineering, photography, and golf; Prof. John Perry's, cycling and novel reading; and Prof. T. Hudson Beare's, entomological work and cycling. Sir Alex. R. Binnie gives his recreations vaguely as "scientific," while the Hon. C. A. Parsons uses the word "various," but notes particularly his practice in rowing—not, presumably, with the aid of the turbine.

Among those who have shown their skill in matters relating to the human body, Sir Frederick Treves refreshes himself with boat sailing and sea fishing; Sir Felix Semon with stalking, shooting, and fishing; Sir R. Douglas Powell with outdoor exercise; Sir William Church with outdoor sports; Dr. H. C. Bastian with walking and researches with the microscope; Dr. G. Sims Woodhead with golf and cycling; and Dr. Forbes Winslow with cricket, lawn tennis, fishing, and croquet. Prof. W. Osler finds the secret of perpetual youth in bibliography. Dr. C. W. Saleeby's amazing industry as a writer on hygienic subjects is mitigated by music and cricket.

A few miscellaneous entries may close this collection. Sir Hiram Maxim, when he is not busy inventing, is reading scientific books and studying the abstract sciences. Mr. Benjamin Kidd is fond of fishing, swimming, and bicycling. Dr. John Beddoe, in spite of his eighty years, can still find interest not only in his anthropological studies but in archæology and statistics. Perhaps the most surprising answer to the editor's query is that of Dr. Francis Galton, who declares his recreations as "sunshine, quiet, and good, wholesome food."

This little inquiry into manners and customs suggests some interesting conclusions. It would appear from the large number of omissions in the returns that many scientific men find in their main investigations all the refreshment they need. Others, when they require diversion, turn to some other branch of science than that in which they have specialized, so that the scientific spirit is still exercised while the mind operates upon novel material. Eliminating all such alleged recreations as might strictly be classified as themselves scientific, a canvass of the voting shows the following results: Golf, 15; cycling, 13; fishing, 9; travel and tennis, of the lawn variety and otherwise, 7; gardening and mountain climbing, 6; shooting, 5; cricket, photography, swimming, music, and yachting or cruising, 4; rowing, walking, and the collection of artistic objects, 3; riding, archæology, croquet, motoring, sketching, and novel reading, 2; while single votes are given for chess, skating, cards, squash rackets, carpentering, building, football, languages, bibliography, folk-lore, and statistics, to say nothing of the characteristic enlogy of the simple life by the distinguished exponent of the science of eugenics.

DECOLORIZING POWER OF ANIMAL CHARCOAL.

Animal charcoal has long been employed as an agent for removing the color from colored liquids, but no satisfactory explanation has hitherto been offered to account for the difference in this respect between animal and wood charcoal. In Mr. E. Knecht's opinion, the explanation is probably connected with the fact that animal charcoal contains from 5 to 7 per cent of nitrogen, while there is only a trace of that element in wood charcoal. His attempts to eliminate the nitrogen by heating the animal product with caustic soda were only partially successful, the proportion of nitrogen in a typical case being reduced from 5.6 to 3.61 per cent; but he found that the decolorizing power, as tested upon solutions of dyes, was reduced as the percentage of nitrogen fell. From the results of his experiments he concludes that: (1) Fixed nitrogen is present in animal charcoal; and (2) the decolorizing capacity is directly proportional to the amount of nitrogen.—Knowledge and Scientific News.

THE CURRENT SUPPLEMENT.

The leading article of the current SUPPLEMENT, No. 1683, is a most copiously illustrated account of the new Cataract Dam for increasing the water supply of Sydney, New South Wales. Mr. Edward W. Parker's exhaustive paper on our coal briquetting industry is brought to a conclusion. Dr. Theodor Koller contributes some helpful suggestions on the disposal of metal wastes. In the fourteenth installment of his treatise on elements of electrical engineering Prof. A. E. Watson writes on alternating current generators. The nature of true boiler efficiency is discussed by W. T. Ray and Henry Kreisinger. Mr. H. W. Pearson's paper on his theory of raised beaches and their cause is continued. We have published a good deal on the subject of the habitability of Mars. In the current SUPPLEMENT some arguments by Dr. Alfred Russel Wallace are published, which tend to show that Mars is not inhabited.

In chemical properties tantalum approximates to gold and platinum. Boiling hydrochloric, nitric or sulphuric acid or *aqua regia* are without action on it, as also are aqueous solutions of the alkalies. It is attacked, however, by fused alkali or hydrofluoric acid; the latter acts slowly under normal conditions, but if the metal is in contact with platinum the action is rapid. Tantalum does not amalgamate with mercury. At a low red heat it rapidly absorbs nitrogen and hydrogen, forming compounds having a metallic appearance. It also combines readily with carbon.

LOWERING THE TRACTION TUNNELS UNDER THE CHICAGO RIVER.

BY L. F. WILSON.

After a number of large steamers had come down the Chicago River from Lake Michigan to the elevators and docks on the south branch, had been loaded, and then in attempting to return had grounded on the tunnels which had been built by the traction companies with their roofs too close to the top of the water, steps were taken to lower these tunnels. This work was begun in 1906. To date, the success of the project, considering the three tunnels as a whole, is a trifle doubtful.

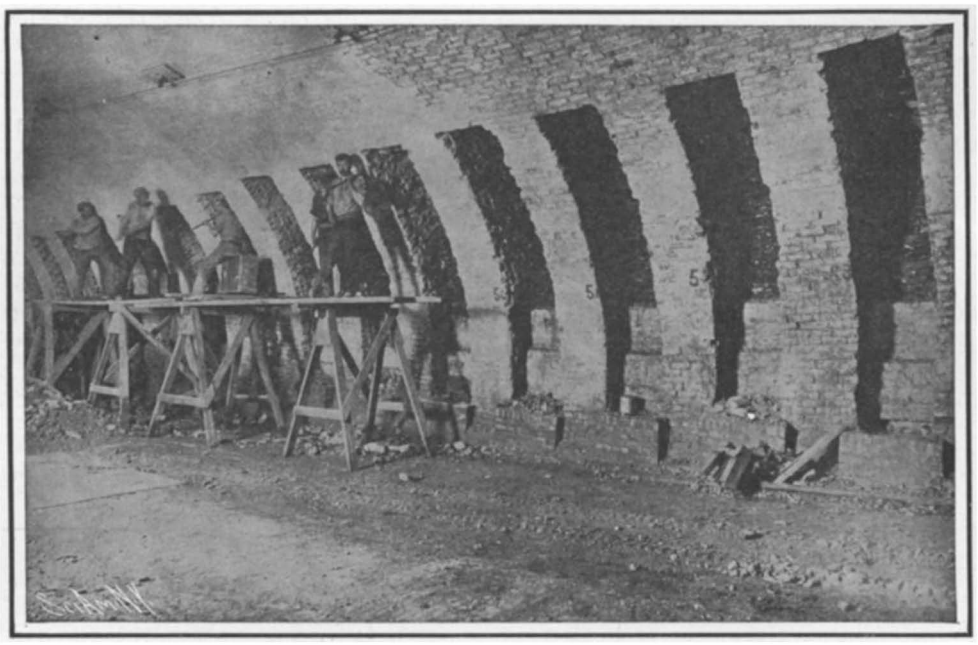
The La Salle Street tunnel was built in three arches, affording an arch each to the incoming and outgoing tracks and a third for a footway. This tunnel was built in 1869-71 and is, or was, 1,890 feet long. It has always been a serious barrier to heavily-loaded steamers in low water, but within the last few years the draft of lake-going vessels has been increased to a point where it is impossible to bring them over the top of this tunnel even at high water.

In the work of lowering, the center arch was attacked first, but hardly any progress was made before a leak developed. This was stopped only a day or two before the tunnel was completely flooded by another leak in the old and imperfect masonry. It was then decided to abandon the project. The roof of the tunnel was blown off with dynamite from the surface of the river, and the structure is now no more than a brick trench in the bottom of the river bed.

In the cases of the Van Buren and Washington Street tunnels a greater degree of success was attained. The specifications called for 10 feet more water over the roof of each tunnel in the channel of the river, making the depth at that point 26 feet. It was only necessary to lower 220 feet of the roof out of the 1,600 feet comprising the length of these tunnels. The floors, however, had to be graded from the street level at each end. The Van Buren Street tunnel was built in 1892, and although it is a trifle shorter than the Washington Street bore (about 100 feet) it had cost just twice the sum in building; and while the Washington Street tunnel is twenty-three years older, it is still in better condition than either of the others. It is an odd fact that the engineer in charge of the present work on the Van Buren Street tunnel is the son of the man who originally designed it.

The minimum headroom in this tunnel is 20 feet. A new roof 10 feet below the old is placed under the center of the river, and is supported by steel columns set into the old wall and surrounded with concrete. On these columns, beams made up of angles and plates were carried across the arch. Upon the beams was placed a layer of reinforced concrete, which was waterproofed on the upper side. At the ends of this new roof, bulkheads were united with the old brick arch. This was a simple job, but the greatest difficulty was encountered in grading the floor from street level at each end to a point 10 feet lower under the river. The old brick arch stood on a foundation of blue clay only a few inches below the floor, and in cutting down below this it was found that no more than five-foot sections of clay could be taken out at one time, as it was calculated that there is a pressure of 18 tons per square foot on the walls of the arch at the bottom, and it was feared that the walls would crumble if the clay were removed in large sections. Trenches 5 feet wide and 10 feet deep were cut in the blue clay across the tunnel and under the walls. These were then filled with concrete to form both the floor and a more solid foundation for the arch. To haul out the clay, a narrow-gage railway was built, and hoisting machines placed at each end to pull the cars out onto a staging and dump them into wagons, which carry the material to the lake front.

The work had not progressed very far before it was discovered that there was danger of cutting into one of the freight tunnels of the Illinois Tunnel Company which the engineers knew nothing of. A new grade was struck, and two feet of concrete left to separate the floor of one tunnel from the ceiling of the other. The accompanying sketch and photographs show clearly the methods used in this work, which is so nearly finished that the old roofs may soon be blown off.



Cutting Recesses in the Side Walls to Receive the Steel Columns.

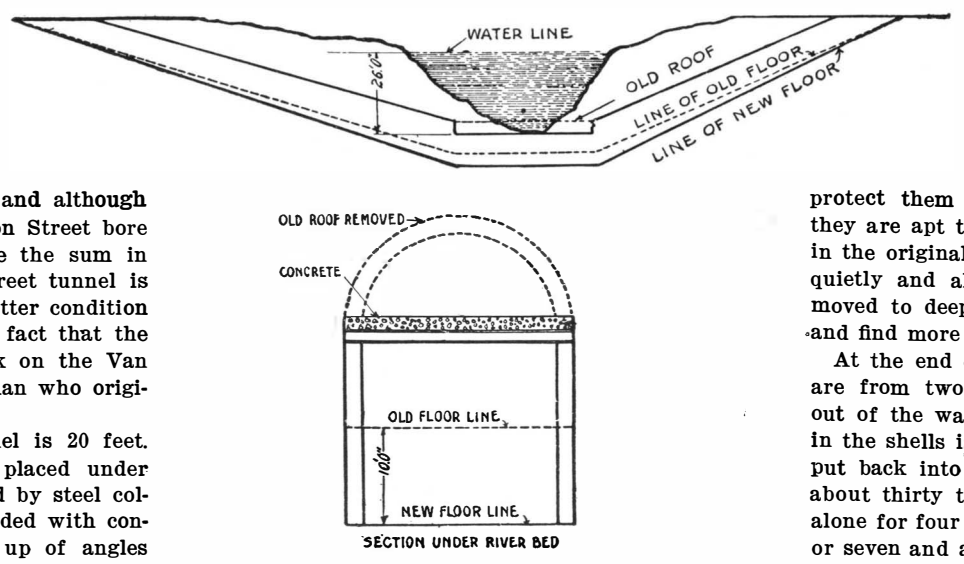
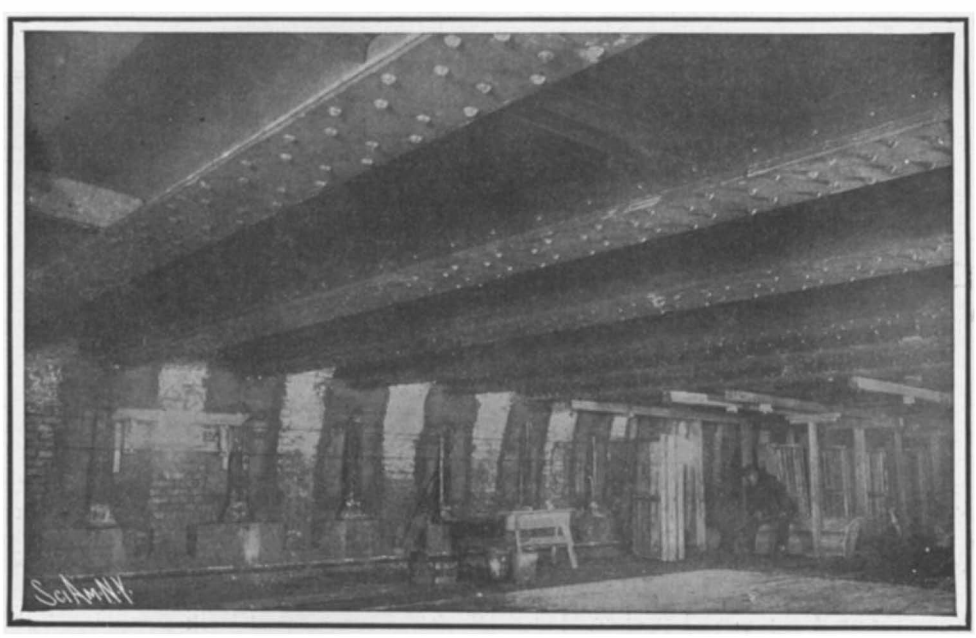


Diagram Showing Method of Lowering the Tunnel.

A patent has recently been taken out in France by M. Bonnet, for a method of obtaining carbon in an amorphous fused condition. The apparatus claimed consists of a vessel of bronze or other metal containing two carbon electrodes, between which is a rod of pure carbon. Beneath this rod is a smaller vessel containing carbon bisulphide, which, when vaporized, will produce a high pressure in the vessel, but will not have any action upon the carbon. The carbon bisulphide is first converted into vapor by means of a slight electric current, and as soon as there is a high pressure from this cause, a high-tension current is passed through the vessel, with the result that in a few moments the carbon rod is fused and converted into the form of black diamond.—Knowledge and Scientific News.



The New Roof Supported on Steel Columns Set Into the Side Walls.

LOWERING THE TRACTION TUNNELS UNDER THE CHICAGO RIVER.

Home-Grown Pearls.

BY CHARLES A. SIDMAN.

There are many peculiar industries and trades, but probably one of the most peculiar of these is a pearl oyster farm. Japan, the land of odd objects, dwarf trees, and ancient temples, boasts of possessing such a farm. The pearl oysters are found more or less along the whole coast. There are some localities famous for producing them in quantities, and many fine pearls have been obtained.

There was a time when fishing for these precious shells was carried to an excess, so that the yield of pearls dwindled to almost nothing. To overcome this difficulty, the desirability of cultivating the pearl oyster was suggested, and met with instant favor. Experiments were carried out with great success, the result being that to-day the pearl oyster farm has millions of pearl oysters on its culture ground, and is able to place annually a large crop of pearls on the market.

This pearl oyster farm is in the Bay of Ago, on the Pacific side of Japan. The bay, like all in which the oyster grows in abundance, is a very quiet piece of water with a most irregular, highly broken up coast line full of deep running inlets, and coves, affording most favorable shelter. The farm is arranged in two parts, the first part containing the young up to the age of three years, and the second part holding those that are over that age.

The breeding season of the oyster is from July to August, and before this comes around, namely, in May to June, stones are placed over the bottom of the grounds in the shallower parts, in order that the young may attach themselves to them, and by August the tiny shells are discovered attached to these stones by their byssus, the number increasing steadily with the season.

The shells are allowed to lie as they are until November, and then those that are near the shore are removed, with the stones on which they are anchored, into depths greater than five to six feet. This is necessary to protect them from cold, from the effects of which they are apt to die in the course of the winter if left in the original places. The young shells are then left quietly and allowed to grow for three years, or removed to deeper water, where they have more space and find more food.

At the end of three years, when the young oysters are from two to three inches long, they are taken out of the water, and the operation of putting nuclei in the shells is performed, after which they are again put back into the sea and spread out at the rate of about thirty to every six square feet. They are left alone for four years more, and at the end of that time, or seven and a half years from the beginning of their life, they are taken out of the water and opened. The "cultivated pearls" are thus harvested and put on the market.

There are many enemies of the pearl oyster, as well as unexpected difficulties in the raising of them. They are attacked by a small worm which eats their shells, are eaten by octopuses, and enveloped by growing sponges which kill them.

Many of the cultivated or culture pearls are either half pearls or only a little more than half pearls, but as regards luster, shape, and size, are most beautiful.

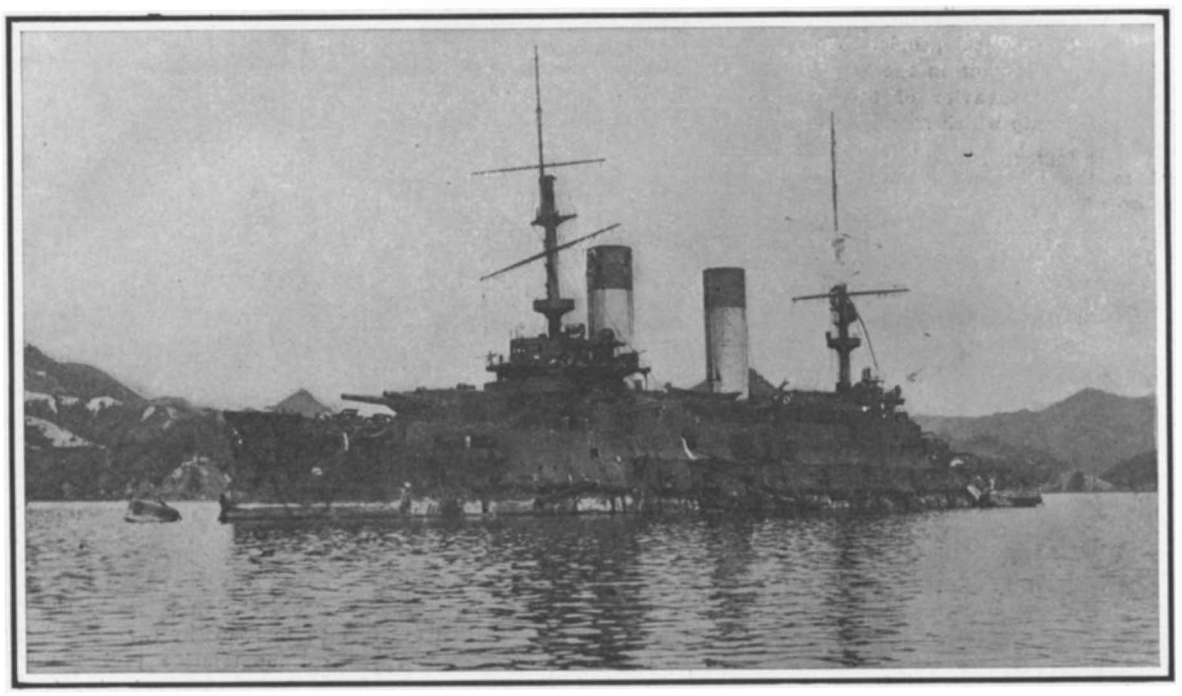
Renovation or Restoration of Fat Substances or Fat Vegetable Oils.—Over the rancid oil, heated to 95 deg. F., from 1 to 1.25 its volume of 90 per cent alcohol is poured and in the course of half a day vigorously shaken three times, so that each time an emulsive-looking fluid is produced. On the following day, the fluid, now divided into two layers, is separated and the oil again shaken up with half its volume of 90 per cent alcohol. This process is repeated according to circumstances three to four times, until the oil treated is pure and tasteless. By distillation, the fatty acids the alcohol has taken up can be separated from it. This method cannot be employed with castor oil, which is soluble in alcohol, nor for cod liver oil, in which the virtue lies in the fatty acids; the same objection applies to croton or heavy bay oil.

JAPANESE BATTLESHIP "IWAMI" AS SHE WAS AND IS.—A LESSON IN "FREEBOARD."

Prominent among the defects which have recently been charged against the United States warships is that of their supposed lack of proper freeboard, or height of upper deck above the water. Judging from the vigor with which this charge has been made, the average layman might readily have been led to believe that the noble fleet which is now in the Pacific consists of vessels that are practically low-freeboard monitors, wet and uncomfortable in a seaway, and incapable of casting loose their guns for action except in calm weather.

By way of teaching us how our ships ought to have been built, the critics have pointed to the French navy, and bid us admire the lofty topsides and towering superstructures of these vessels, with their guns mounted in turrets poised over 30 feet above the water. Here, we are assured, are ships that are ideal, capable of steaming at full speed in heavy weather and able to fight their guns without distraction of flying scud or green water.

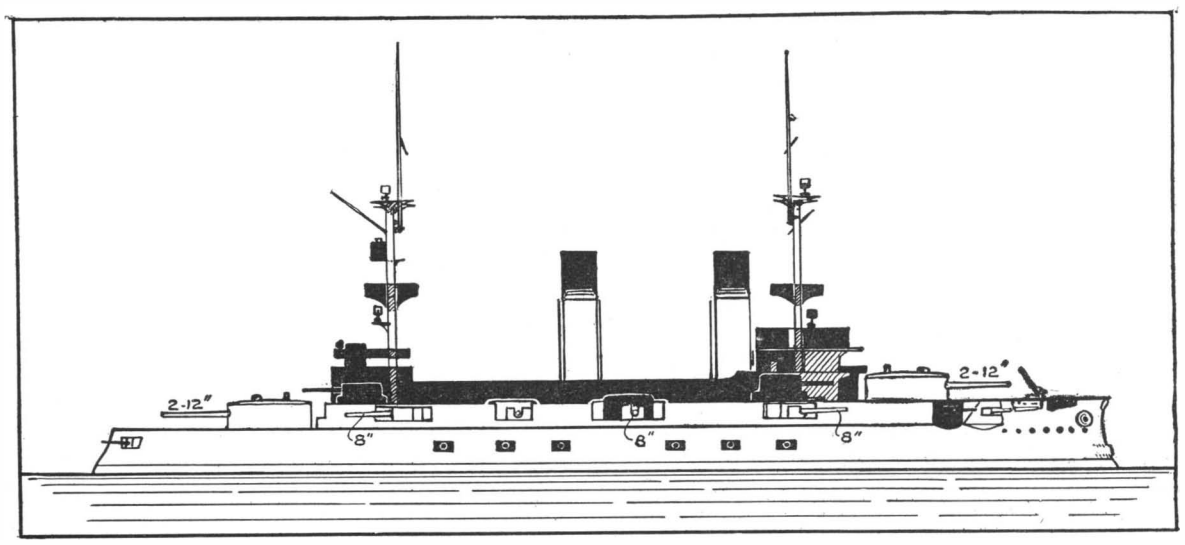
We have heard a good deal during the last few months about the lessons of the Japanese war; and if it be as true on the sea as on the land, that an ounce of fact is worth a ton of theory, one cannot ring the changes upon these "lessons" too often or with too much emphasis. There has just come to the Editor's desk another lesson, this time in the shape of two photographs of the Japanese battleship "Iwami" (formerly the Russian "Orel") accompanied by a letter from Mr. Saito Tsunetaro, of Tokio, Japan, which is decidedly illuminating on this question of moderate versus exaggerated freeboard. The first of these photographs shows the "Orel" at the close of the battle of the Sea of Japan; the second shows her two years and three months afterward, when the work of reconstructing her was completed; and they demonstrate how that highly intelligent and very clever people succeeded in transforming the high-freeboard, French-type "Orel" into the moderate-freeboard, British-American-Japanese type "Iwami."



Displacement, 13,500 tons. **Speed,** 18 knots. **Armament:** Four 12-inch; twelve 6-inch, carried in six turrets; twenty 3-inch.

The "Iwami," formerly "Orel," After the Battle of Tsushima Strait.

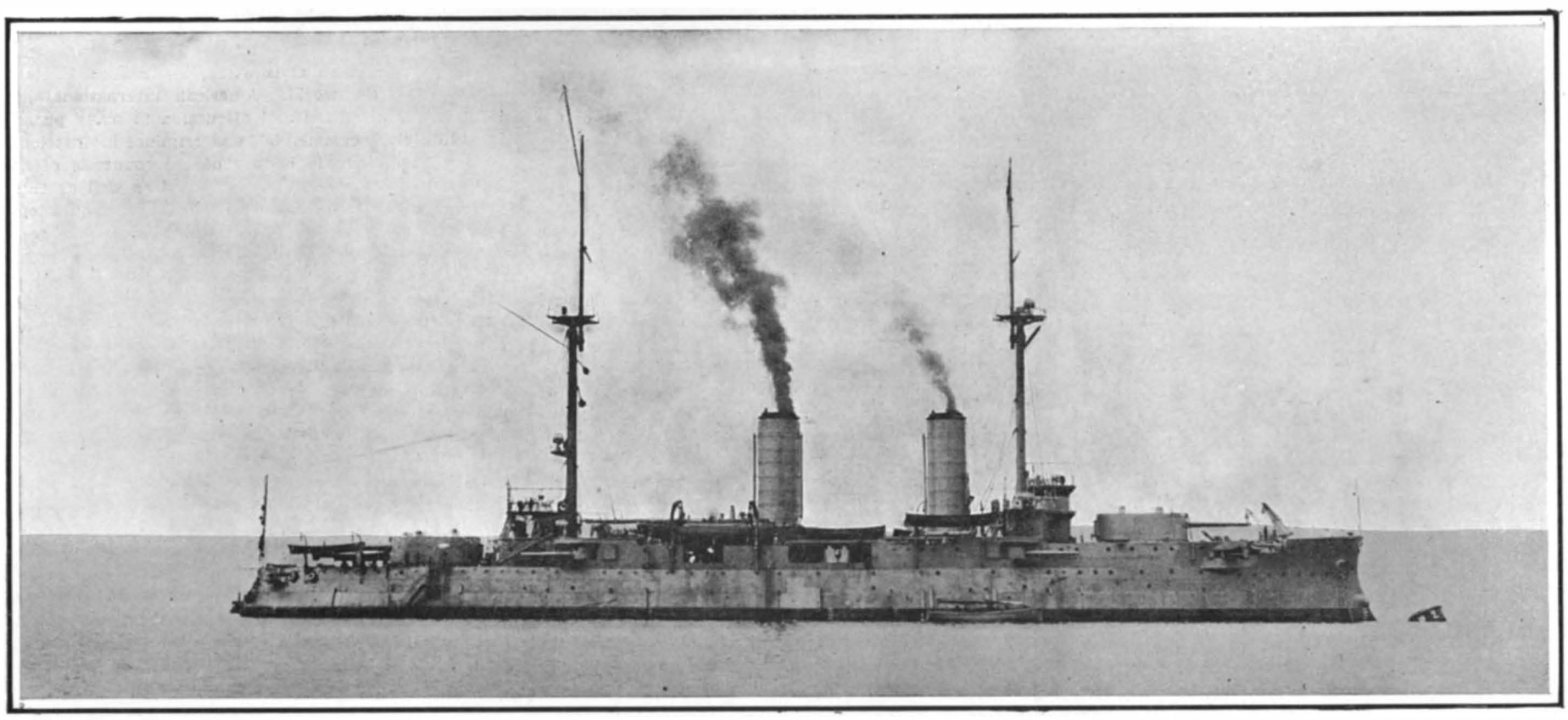
The "Orel" was one of four new battleships of the "Borodino" type, which formed the main reliance of Rodjestvensky's ill-fated expedition. She was a vessel of 13,500 tons; and like the others of her class she was modeled very closely after the "Czarevitch," which was built in France from French designs. The distinguishing characteristics of these ships were their exaggerated freeboard, their lofty bridges and towering superstructures, their enormous and lofty smokestacks and the curious tumble-home of the topsides. The majority of the heavy guns were mounted at an elevation of fully 32 feet above the normal waterline. The forecastle deck was 28 feet above the same mark, and above this deck, in the "Orel," was a bridge deck loaded with boats, booms, and tackle. These lofty weights were bound to have a most dangerous effect on the stability, as was proved in the battle of the Sea of Japan, when several of these ships turned turtle and went to the bottom.



Before her capture from the Russians the "Iwami" was a high-freeboard ship with most of her guns carried 32 to 34 feet above the water. In this respect she embodied the features which our navy critics wish to see incorporated in our own ships. After her capture the Japanese, as the result of their experience in the war, cut down the freeboard amidships by 8 feet; abolished six of the lofty turrets; lowered the secondary battery to the main deck; cut off 20 feet of the smokestacks, and removed the flying bridges, the fighting tops, and the whole of the superstructure.

Diagram Showing the "Iwami" as She Was (in Black) and as She is (in White).

The events of that famous sea fight afforded an ideal test of those principles of naval construction which the critics of our navy are so very anxious to have us adopt. Admiral Togo in his dispatches to the Mikado spoke of the sea being "rough," and other observers present at the fight have agreed with him. Opposed to Rodjestvensky's lofty ships was a fleet made up, without exception, of ships of moderate freeboard, having the same, or if anything a little less freeboard than the battleships of our own navy. They carried their guns sufficiently high above the water to be free from interference by green seas or heavy spray; and they presented only a moderate mark for the Russian gunners. The French type of Russian ships, on the other hand, derived no particular advantage from the lofty mounting of their guns; while they were placed at enormous disadvantage because of the huge targets which they presented to the Japanese gunners. We need not go into the story of the fight. It is sufficient to say that the "Orel," the only one of the French-type ships in this battle that was not sent to the bottom, was found, after her capture, to have been literally riddled in her lofty and quite useless upper works, the horrible confusion and wreck of which was illustrated very graphically in photographs of the ship published in the SCIENTIFIC AMERICAN of January 20, 1906. Although the unarmored superstructure was thus badly damaged, the ship below the main deck was found to be not seriously injured.



Displacement, 13,500 tons. **Speed,** 18 knots. **Armament:** Four 12-inch; six 8 inch in casemates; twenty 3-inch. Note the lowering of freeboard and the reduction of height above water of the secondary battery.

The "Iwami" After Reconstruction by the Japanese.

JAPANESE BATTLESHIP "IWAMI" AS SHE WAS AND IS.—A LESSON IN "FREEBOARD AND LOFTY GUNS."

Now the Japanese have proved themselves to be an essentially practical people. We may be sure that the changes they made in the "Orel" were determined by the relative behavior of the two widely-different types of battleship which fought it out in the Tsushima Straits. It is a highly significant fact, which we commend to the leisurely and thoughtful consideration of those officers who would have us build our future battleships after the pattern of the French battleship "La Patrie," that in rebuilding the "Orel" the Japanese aimed to take out of the ship, as far as they could do, just those very elements and characteristics which the late critics of our navy would have us put into our ships. In the first place, they cut down the freeboard of the vessel by the height of one deck, cleaning off the superstructure altogether. They abolished the fighting tops, removed the huge and lofty pilot house, removed six turrets with their twelve 6-inch guns, and brought all of the main armament, except the forward pair of 12-inch guns, down onto the main deck, which has the same freeboard, 18 to 20 feet, that is found in the ships of the Japanese, the British, and our own navy. The 28-foot freeboard forecastle deck was allowed to remain at its former height, the cost of lowering the forward 12-inch guns and turret, and cutting down the barbettes, being too great an expense to be considered. In addition to removing altogether the four lofty 6-inch gun turrets on the spar deck, the Japanese also removed the two 6-inch turrets amidships on the main deck. In place of the twelve 6-inch guns in these six turrets, the Japanese mounted six 8-inch guns on the main deck in the positions shown in our engraving. From the main armor belt upward, and over the greater part of the length of the ship, the topsides were entirely remodeled, the French "tumble-home" being removed, and the sides carried up approximately vertically, after the fashion of the other Japanese battleships. Also the smokestacks were reduced about 20 feet in height.

Formerly, the gun deck of the "Iwami" was pierced for twelve 12-pounder guns. The lower sills of the ports were not over 9 feet above the water when the ship was in the fully loaded condition. These ports were abolished in the reconstruction, and, except at the stern, where there are two 12-pounders, there are no gun ports in the ship below the main deck. The armament of the ship now consists of four 12-inch, six 8-inch, twenty 12-pounders, twenty 3-pounders, and six 1-pounder guns.

The Japanese have certainly succeeded in transforming a cumbersome and ungainly-looking ship, which embodied several most undesirable features, into a trim, smart-looking craft that may be considered thoroughly up-to-date with ships of her class. The speed of the Iwami is equal to that which she made when she first left the builders' hands, or 18 knots an hour. We are informed by Mr. Tsunetaro that the cost of reconstructing the "Orel" amounted to three million yen.

LIPPMANN'S METHOD OF STEREOPHOTOGRAPHY WITHOUT A LENS.

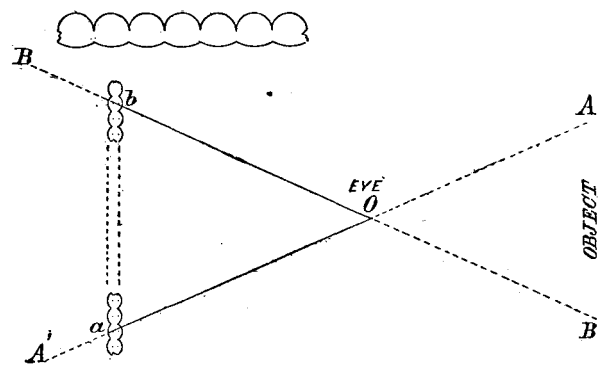
BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Prof. G. Lippmann has devised a new method of obtaining stereoscopic photographs by exposing a prepared plate without a lens directly to the landscape, for instance, upon which plate is produced a stereoscopic view directly visible by looking at the plate in the ordinary way. As in real life, the perspective changes with a change in position. The principle of M. Lippmann's process is as follows: A sensitized celluloid film of the usual kind is employed. Before it is sensitized, the emulsion is pressed while hot in an embossing machine so as to cover each side of the film with a number of small elevations in the form of spherical segments. Each one of the elevations on the plain or non-coated side of the film is designed to form a minute lens. On the other hand, the elevations on the rear face are coated with the emulsion, each being designed to receive the image which is formed by one of the small lenses of the front. The diagram shows an enlarged section of the prepared film. The system formed by one of the small front lenses and the curved part in the rear covered with the emulsion, constitutes in fact a minute camera of spherical form, very closely resembling an eye. On account of its small diameter, the minute camera will be practically in focus for all points of the distant object. It is an advantage to separate each element from the next one by a black substance. If we give the name of "cell" to each elementary camera, we see that the entire film is an assemblage of such cells. If each cell forms a single eye, their aggregate is somewhat like the multiple eye of an insect.

Such an arrangement has several quite remarkable properties. In the first place, it will produce photographic images without the assistance of a camera. We only need to place it in direct light before the object to be taken. A camera is not required because each cell of the film is a camera in itself. The film must be kept, of course, in a dark box until it is used. The box is opened only for the necessary exposure, keeping the film in a fixed position during this time. The box is then closed and the film is developed and fixed in the dark room in the usual way. The result of these operations is a series of small images, each being fixed upon the "retina" of one of the cells. When looked at from the side of the emulsion, these images cannot be distinguished by the eye, and we have the impression of a uniform gray layer. But when the eye is placed on the other side and the plate is observed by transmitted and diffused light, such as a piece of white paper placed back of the film would give, the eye will see in the place of the system of minute images, a single image projected in space.

Let us take any point a or b of one of the small images. The light comes from A' and B', and the eye is placed at O. The simplest demonstration is to observe that any camera in which we put back the negative (or positive) in the original place which it occupied, becomes a reversible apparatus; that is, if we send light through a point a of the plate, which was the focused image of a point A of the object, the rays which are sent through the plate and the lens are convergent and meet now at A. This principle applies to all the points a b c which are the focused images of the points A B C of the object. In this way the real images which are formed in space by the convergence of the rays occupy the same relative positions with relation to the system of cameras and also to one another, as the material points of the object which served to emit the rays in the first place. The system thus forms a virtual object of three dimensions. For the observer's eye, this is the equivalent of the system of material points which it is desired to reproduce. The eye will see these points, provided it is properly placed with reference to them. This aspect changes with the positions of the eye, and as the two eyes occupy different positions, they will see corresponding perspectives. Thus we realize the conditions needed for seeing objects in relief, without the use of a stereoscope. What is remarkable also is that the aspect of the picture changes with the position of the spectator. just as if he were in the presence of the reality.

When the film, developed simply as a negative after the exposure, is thus examined the image is seen as a



PRINCIPLE OF LIPPMANN'S METHOD OF MAKING STEREOSCOPIC PHOTOGRAPHS WITHOUT A LENS.

negative, and the white parts appear black. Besides, the image is reversed, with the bottom upward and the left to the right, each point a being seen on the extension of the line $O A$. It is necessary, therefore, to rectify the image, and this can be done in two different ways. First, the developing can be carried out so as to obtain a direct positive image after the well-known processes, and the plate then turned about through 180 degrees so as to have the image in an upright position. A better method is to develop the negative and then copy it upon a second film which is placed opposite the first one at an arbitrary distance of about one inch. The contact of the two is not required as in the usual case, because each cell of the second film "sees," as it were, the negative and reversed image No. 1, and rectifies it by a second reversal. By this latter method, the number of positive copies can be multiplied at will.

The perceived image is continuous, provided the cells are near enough together in the film. In fact, if the opening of the pupil were infinitely small, each of the elements would be a point and they would be reduced on the retina to a series of separate points, but they would appear to touch nevertheless, provided the cells were small enough and close enough together so as not to be distinguished. But in fact the diameter of the pupil has a certain size, and each element will also have a certain extent on the retina. They will join in reality, provided the distance between two cells of the film is less than the diameter of the pupil. At each instant the observed image is bounded by the edges of the film, just as would be the view of exterior objects by the edges of a small window through which a landscape, for instance, is observed. By moving the head, we see other objects framed in the same border, and by a sufficient movement we make the tour of the horizon. It would not seem at first sight that a single photographic plate could show a succession of different views, but this result is easily explained. When we are opposite the plate, the resulting image which seems to be projected in space is the combination of elements each of which is taken from the central portion of one of the small cellular images occupying the whole surface of the plate. When the plate is observed obliquely, the combination is made from the elements taken from the sides of the cell images. If the cells give an angle of 120 degrees, for instance, we can sweep over 120 degrees of landscape by shifting the head. The perception is thus varied inasmuch as each cell carries at its back a panoramic view of the landscape.

Another point to be noticed is that when the direction of the light rays is reversed in a camera, that is, when it is used as a lantern for projecting the image on a screen, the rays upon leaving the camera take the same path as for entering. Accordingly, the distortions of the image due to imperfections of the lens have no effect, because they are eliminated owing to the reversal which takes place, and in spite of the imperfections of the lens, it works as if it were perfect.

There is one condition to be fulfilled which must be noticed. In order to have each of the images focused at the back of the cell, the relation of the radius of the front curve to that of the rear curve must be equal to $n - 1$, where n is the index of refraction of the celluloid for the most active rays. This condition, simple as it may seem, is quite difficult to realize with sufficient accuracy, owing to the small depth of each cell. This difficulty can be overcome only by the use of an embossing or molding machine of great precision. Collodion and celluloid are not the only refractory substances which can be used. Glass also allows of obtaining spherules which act as lenses and these are made in numberless quantities. But it is necessary to sift them with precision and to fit them upon a collodion membrane which gives the well-determined extra thickness. The varieties of glass of commerce have an index of refraction which may exceed 1.9 (for Jena glass), but which does not reach 2.0 at present. If we were able to make $n = 2$, the technical difficulty mentioned above would disappear. We can demonstrate in fact that if a refracting sphere has an index equal to 2.0, the parallel rays which it receives will converge on the rear surface. Such a sphere which has a gelatine emulsion coated on one-half its surface will form the simplest of cameras, and will be always in focus for distant points whatever may be its diameter. The molybdates and tungstates of lead have indices of refraction greater than 2.0, and by mixing them with silicates it may be possible to increase the index of the mixture. But up to the present it has not been possible to prevent the mixture from crystallizing. However, these are difficulties of a technical order which are not insurmountable.

Pan-American Scientific Congress.

With President Roosevelt's enthusiastic approval, officials of the Department of State are endeavoring to add the full weight of the leading social scientists of the United States to the deliberations of the first Pan-American Scientific Congress, which is to be held at Santiago, Chili, next December. Congress has been asked to appropriate $35,000 that twenty-five delegates may go to the congress officially representing this country. Besides, the leading universities have indicated their interest, and many of them will doubtless be represented independently.

The congress is to consider American social problems, with a view to showing the advantage of all countries of this continent regulating in a uniform manner some of their institutions or public departments, thus strengthening their relations of friendship.

A comprehensive programme to govern the discussions, which are to begin December 25 and continue for ten days, has been arranged. It begins with a review of American civilization, its development and influence on the world. American international law is down for definition and discussion in many phases, including civil, commercial, and criminal international law. The diplomatic history of the countries of the American continent will be reviewed as well as their political economy—commercial and customs questions, immigration, irrigation, etc. Many questions are down for discussion regarding government action in economic crises, and the feasibility of government control of corporations, also the relation of labor wages to the needs of the laborer, the improvement of labor conditions, and the question of labor organization.

Police and criminology present two prolific heads for detailed topics, while American literature, fine arts, and universities likewise are general subjects.

A novel standardization test of Cadillac cars has recently been held in England. This test consisted in completely dismantling three standard Cadillac machines, even to the minutest parts; mixing said parts promiscuously; and afterward reconstructing the machines and giving them a 500-mile test at full speed upon the Brooklands track. The machines were pulled apart and reassembled in sheds beside the race track, the parts being thrown about upon the sandy floor without any care whatever. Despite such abuse, the motors when put together again with parts belonging to their mates, operated perfectly. The test was a splendid demonstration of the complete standardization and interchangeability of parts used in the construction of the modern car.

A NEW APPARATUS FOR SUBMARINE OPERATIONS.

That which makes deep-sea diving dangerous is not so much a question of furnishing the diver with air, but the difficulty of protecting him from the weight of the overlying water. Each foot of descent increases the pressure on every square inch of his body by nearly half a pound. A depth of 100 feet develops a crushing pressure per square inch of 43 pounds, or a total of as many tons on the entire body of the diver. Naturally, such being the conditions, the diver's profession is not overcrowded. Few men can stand the strain of a 100-foot submergence, and many dare not venture below 50 or 60 feet. As occasion often arises when it is imperative that work be done at greater depths than these, efforts have been made of late to provide divers with metal suits which will completely protect them from dangerous water pressures.

Our front-page illustration shows an entirely new method of conducting work in the deep sea. The advantages obtained by this method are that the diver is protected in every way, and is at the same time in free communication with the surface. He breathes air under normal pressure, and is free to ascend or descend at any time without having to give a signal to operators above. Furthermore, his connection with the surface is not maintained by means of a slender tube and line, but by a large vertical standpipe, which he may climb at will. As clearly indicated in the illustration, the new apparatus comprises a caisson, or operating chamber, fitted at the top with a large collapsible tube or shaft, which extends to a float or barge at the surface of the water. The shaft is made up of a series of sections terminating in flanged rings, whereby the sections may be bolted together. Each section consists of a flexible covering stretched over a series of metal rings of I-shape cross section. By means of the chain hoist connected with the top of the operating chamber, the apparatus may be lifted up to the surface, collapsing the vertical shaft and permitting the operating chamber to rise into a housing in the barge. As the apparatus is raised the sections are unbolted and stowed away.

The operating chamber is entirely sealed, except for its connection with the tube. No air pumps are necessary, as free communication with the outside air is had through the open vertical tube. The chamber is provided with glass-covered windows, through which the surroundings may be examined. The side walls of the chamber are formed with protruding parts, which are furnished with windows on all sides, and serve as helmets for the operators. Armholes in these protruding parts are fitted with sleeves of flexible material. In use the operators climb down the vertical shaft, using the stiffening rings as a step ladder, and when in the operating chamber they can by means of the sleeves reach out and conduct the ordinary operations of the diver, while fully protected within the operating chamber. Articles that are to be lifted to the surface may be attached to grappling irons let down from the barge. To facilitate the work, electric lights may be lowered into the water outside of the operating chamber. When it is desired to move to a new spot, the chamber is lifted sufficiently to clear the bottom, and the barge may then be towed to the proper position. It will be observed that the lower sections of the tube are somewhat collapsed, as compared with the upper sections. This is due to the pressure of the water at the bottom; and owing to this collapsed condition the sections are heavier near the bottom, and consequently serve to weight the apparatus and hold the tube vertical.

An experimental apparatus of this type has already been tested in the James River by the inventor, Charles Williamson. To be sure, the fact that the operating chamber is not free to travel about without moving the barge, limits the field of its operations. However, there should be many conditions under which it could be used to advantage.

One of our illustrations gives a hint as to how the device may be used alongside a vessel to provide access to the exterior of the hull for purposes of making repairs or cleaning off various marine growths. Aside from its advantages for diving operations, the apparatus may be used at amusement parks to furnish visitors with a view of under-water conditions or for exploring the bottom of a river or other body of water.

Death of Justus A. Traut.

The Hon. Justus A. Traut died recently. Mr. Traut's death removes a man of rare inventive ability. He was born in Potsdam, Germany, in 1840. He was the son of Mr. and Mrs. F. A. Traut. His father was an inventor and devised a wood veneering machine which made him wealthy. The son showed a marked inventive bent and obtained patent after patent as the years rolled by, inventing various labor-saving machines which now have world-wide use. He took out so many patents that he himself almost lost track of the exact number.

Mr. Traut was one of the founders of the Traut & Hine Company, one of the most successful of New Britain's younger concerns, and was its president.

Correspondence.

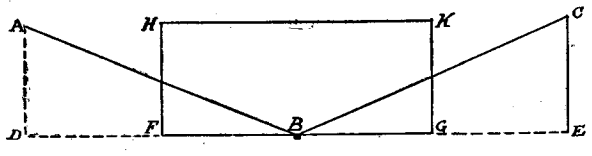
A Letter from Mr. Hargrave.

To the Editor of the SCIENTIFIC AMERICAN:

To the readers of the SCIENTIFIC AMERICAN who are noting, with some slight knowledge of rigid mechanical structures, the trend in the evolution of the aeroplane flying machine, the question must frequently suggest itself, Why did Dr. Langley make his supporting surfaces on the dihedral instead of the cellular plan? I confess I cannot render a reason; he had accurate drawings of cellular structures from Australia such as the engineer's soul loves, and none could read them better than he could; yet the one-man aerodrome was twice wrecked by the gilguys necessary to tie the widespreading wings in position, and the disappointment that ensued, we are told, tended to shorten a valuable life.

The first cellular kites were described in 1893, and in 1896 I put the proposition before our Royal Society in these words: "The great stability of the cellular kite is due to the vertical surfaces. To understand this, it is necessary to grasp the truth that a perfectly flat kite has no stability, and even with tail and side ropes is an inferior flyer. The more the kite bends back from the longitudinal center line or backbone, the more stable it becomes. The angle between the two sides is called by flying-machine men the dihedral angle; and without this or its equivalent, no flying apparatus will balance with any degree of certainty.

"Let *ABC* be the dihedral angle of a kite, *B* being the end view of the backbone. Resolve *AB* and *BC* into their components, and *DBE* is the breadth of sur-



face that tends to lift the kite, and *AD* and *CE* the heights of the surfaces that tend to steady it.

"Bisect *DB* and *BE*, and erect perpendiculars *FH* and *GK* equal to *AD* or *CE*. Join *HK*: and *FHKG* is the breadth and height of a cell having the same lifting power as *ABC* and (apparently) greater stability.

"The width of the kite *DE* is halved, and therefore much less timbering (strutwork) spreads an equal area of lifting surface, to say nothing of the rigidity of the lattice girder construction," etc.

I wish, for the good of the cause, that Messrs. Wright's aeroplane had been shown on your trophy, as the prominence given to Dr. Langley's aerodrome will inevitably lead to its being copied by many Americans, who may in consequence be sidetracked by early failures. LAW. HARGRAVE.

Woollahra Point, Sydney, N. S. Wales, January 6, 1908.

Naval Criticisms.

To the Editor of the SCIENTIFIC AMERICAN:

Is there any way in which the American public can have accurate information in regard to the United States ships of war when such valuable papers as the SCIENTIFIC AMERICAN and The Navy accuse each other of being biased?

And while much of the criticisms have been apparently too severe, still some of it is doubtless justifiable.

In your issue of February 22, you complain of The Navy not treating the subject from a common basis; but are you on a common basis when you compare the height of the guns of the armored cruiser "Drake" with the battleship "Connecticut"? You could just as consistently compare the height of the guns of a destroyer with the "Connecticut."

The Navy makes a statement that the "Connecticut" has never been down to her full-load draft of 26 feet 9 inches since her trial trip. Now, if that be true—and you don't deny it—it is a very serious fault, even if her armor belt reaches as far as the top of her funnels. It would be interesting to know the speed of the "Connecticut" at her alleged full-load draft of 26 feet 9 inches, to say nothing of the 28 feet 8 inches that The Navy claims she draws.

There would be some satisfaction in having foreign ships draw more than their normal and full-load drafts, but do they? If our ships are not designed to allow for the necessary stores, etc., that is no reason why we should think that foreign ships are no better provided for.

And yet our Navy Department are not the only ones that make mistakes, for I understand that the famous "Dreadnought" (but she's not the whole British navy) draws 2 feet more than designed for, when fully loaded, and I don't suppose that means that she makes a cargo steamer out of herself. What are all those extra fittings, etc., that our battleship fleet has on board that you mentioned? Are there any extra 12-inch guns aboard?

In making the same trip, would the ships of the "King Edward VII.," "London," "Duncan," "Canopus," and "Swiftsure" classes have to load down to 4 feet below their normal draft? England has sent some big battleships as far as China; did they?

You point out The Navy's inconsistency in saying that their own figures would make the "Connecticut" a 20,000-ton ship, and yet on another page they give the official figures for the displacement. Rather a flimsy argument, for the "Dreadnought" is always spoken of as a 17,900-ton ship, and in reality she must be over 20,000 tons. It is obvious that the "Connecticut" and "Dreadnought" are much more efficient at their designed displacements.

The trouble with our ships is that Congress limits the trial displacement, and the Navy Department crowd all the guns and armor in them that they can, when it would be much better for our ships if they would limit the cost. FRED SAUNDERS.

San Francisco, Cal.

[The "Drake" is of over 14,000 tons displacement and bigger than many battleships. Her guns should, therefore, be as high if not higher than similar guns on battleships. The exaggerated statement of overdraft and submerged belts have never been verified by official figures. They stand on the mere say-so of people who in the same breath assert that "the openings above and below the guns in the turrets (of the 'Kentucky') are ten feet square." With equal overloading, foreign ships of similar size and form would be equally submerged. If the "King Edward VII." and other British battleships were loaded down with such miscellaneous freight as was carried by our Pacific fleet, they would have sunk equally low in the water.—ED.]

Contest to Be Held in Italy for Non-inflammable Buildings.

Consul Albert H. Michelson, of Turin, reports that, in view of the damages caused by fire to previous international expositions, the Italian executive committee of the International Exposition to be held in Turin in 1911 has instituted an international competition to test the relative merits of various materials and processes, whereby the timber and textile tissues to be used in the construction of the buildings of the said exposition may be rendered non-inflammable. The consul describes the plans:

The fireproofing materials in question will be divided into those for the protection of timber and those for the protection of tissues. For timber a speedy and cheap method of superficial coating will be preferred, although other processes will be given every consideration. The timber treated must not be rendered unfit for polychromic decoration of any sort. Tissues must be treated in such a way as to impair least their strength, elasticity, and coloring.

Materials, whether destined for the protection of timber or tissues, must be furnished, free of all charges, to the "Direzione del Laboratorio di Chimica Docimastica del Regio Politecnico di Torino," before September of this year, and must be supplied in sufficient quantities to protect at least 50 square meters (538 square feet) of timber or tissue, as the case may be.

The executive committee states that it reserves the right to purchase such fireproofing materials as shall have been judged worthy of an award, in quantities sufficient for the protection of all exposition buildings. Competitors are therefore required to forward with their samples a statement setting forth the amount of material they will engage themselves to supply, and the price thereof, c. i. f. Turin. They should also furnish, for purposes of identification, an exact description of their material, together with detailed directions regarding the manner and method in which the material is to be tested. The consulate suggests that although such directions should be in English, for reasons of complete accuracy it might be well to furnish translations thereto either in French or Italian.

The jury appointed by the executive committee will judge promptly, in a technical, practical, and economic light, the samples submitted to it, and will make such tests as it may deem proper. Competitors are at liberty to attend these tests, either personally or by proxy, but can not appeal from any decision that the jury reaches.

The awards which the jury itself has at its disposal consist of two gold and two silver medals (the first and second prizes for each of the two classes of materials mentioned), and $800 in cash, to be distributed among such competitors as the jury may deem especially worthy of reward on account of research work performed by them, or on account of noteworthy results produced.

Lemoine's Diamonds.

It is reported in the newspapers that the French electrical engineer Lemoine, charged with having swindled Sir Julius Wernher of more than $300,000 by selling an alleged invention for making diamonds artificially, has failed to prove to the court that his method is feasible. The investigation, it is said, showed that it was impossible to make gems of the size that he claimed.

THE MANUFACTURE OF MECHANICAL ORGANS.

BY JACQUES BOYER.

The mechanical organ appears to date from about 1745, at which epoch Langsaw made barrel organs which played pieces composed expressly for them by Handel. At the end of the eighteenth century an organ maker of Modena named Barberi invented similar instruments which became popularly known as Barbary organs, from a corruption of or a pun on the maker's name, and which won great favor in Paris. The use of these strident instruments has persisted to this day and hand organs for itinerant musicians are still made in France, chiefly in the department of the Vosges. The operator, by turning a crank, sets in motion a cylinder provided with studs or projections of various lengths which, as the cylinder revolves, press intermittently on a series of metal keys. The keys, in turn, open the stops of a series of pipes through which air is blown by a bellows which is also driven by the crank. Several tunes are written, or rather represented by cams, on the cylinder and are played in turn by displacing the cylinder longitudinally. Unfortunately, the music of these instruments is distressing, rather than pleasing, to sensitive ears, and the repertoire of the best hand organs of this type is limited to a dozen pieces at the most.

An instrument of far higher character is the mechanical orchestra, as constructed by MM. Limounaire, of Paris, which produces the effect of a full orchestra and has an unlimited programme because it practically reads music like a human performer. The notes, however, are not printed, but are punched in a long sheet of flexible cardboard or thick paper, the length of each perforation being proportional to the duration of the corresponding crotchet, quaver, semibreve, etc. As the sheet is drawn along with uniform speed by a motor or a crank a series of teeth drop into and out of the perforations, and each tooth opens and shuts the valve of a particular pipe by means of a train of levers. Consequently, each pipe "speaks" for exactly the length of time required to produce the proper musical effect. An indefinite number of perforated rolls, representing musical compositions of every character, can be supplied with the instrument (a certain number being stored in its case) or at any future time, so that there is no limit to the repertoire.

These orchestrions are made of various types and sizes, from the small portable model turned by hand to very large and elaborate instruments driven by power. Each instrument requires the work of at least twenty-four skilled artisans, including adapters of music, turners, wood and metal workers, adjusters, sculptors, and decorators.

The pipes are made of pine and oak, selected with reference to their sonorous quality and freedom from a tendency to warp. Each pipe consists of four boards of the proper length and width for the tone desired, mounted vertically on a massive wooden base, in the front of which a deep furrow is cut with saw and chisel. The vertical section of this furrow, or cavity, is a right-angled triangle, the hypotenuse sloping upward from back to front. The cavity is closed in front by a thick plate of wood which forms the lower lip of the mouth of the pipe, the upper lip being made by cutting away the lower part of the front board and beveling the edge. Thus the air, entering the cavity through a hole bored in the bottom of the base, is directed against this beveled lip and set into vibration. The escape of the air is facilitated by two grooves, one in the upper lip, the other in the diagonal face of the cavity. The walls of small pipes are merely glued together, but those of the larger ones are dovetailed.

From the joiners the pipe goes to a skilled workman and musician, who finishes the lips of the *embouchure* so as to produce the desired *timbre* or quality of tone.

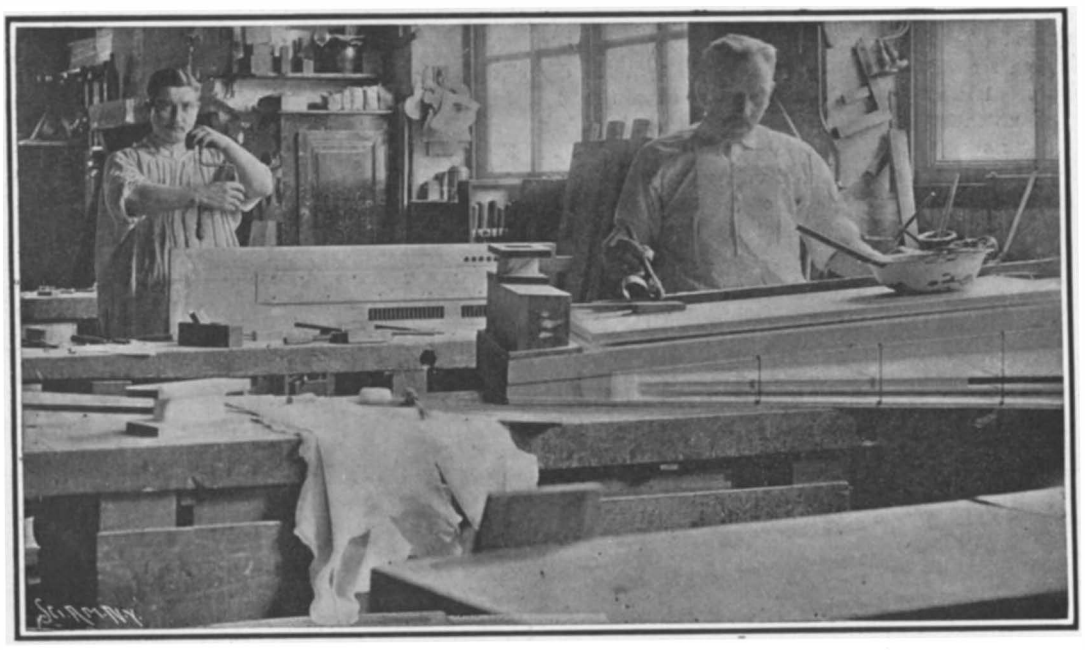
In the bellows room are made the metal frames of the bellows and these are then covered with flexible leather. The making of these lungs of the orchestrion is not the least difficult and delicate part of the manufacture. In the same room we find a workman making the wind chests, which receive the air from the bellows and distribute it, by means of an arrangement resembling a Venetian blind, to the various pipes which are mounted on them. Smaller wind chests are connected by rubber tubes with the pneumatic motors by which the perforated cards are drawn along.

Other rooms are devoted to the manufacture of accessory orchestral instruments, such as drums, xylophones, and triangles, which are played in strict time by appropriate mechanism, and to the designing, carving, painting, and gilding of the little wooden puppets that perform various evolutions in galleries and niches on the façades of the more elaborate orchestrions. Among these figures are dancing shepherdesses, strutting and bowing toreadors, cymbal players, and orchestra leaders beating time. Some of these orchestrions are of imposing dimensions and their fronts are exceedingly ornate, the pipes, bellows, and mechanism being entirely concealed by paintings and sculptures.

Music is often written expressly for these orchestrions by composers of talent. From the orchestra score, as written by the composer, the places of the perforated notes are marked on the cardboard sheets by men and women of musical training. The sheets then go to the perforating room where girls perforate them on machines resembling sewing machines. The sheet is now ready for use and the composition is played by merely inserting it in the instrument and starting the motor or crank.

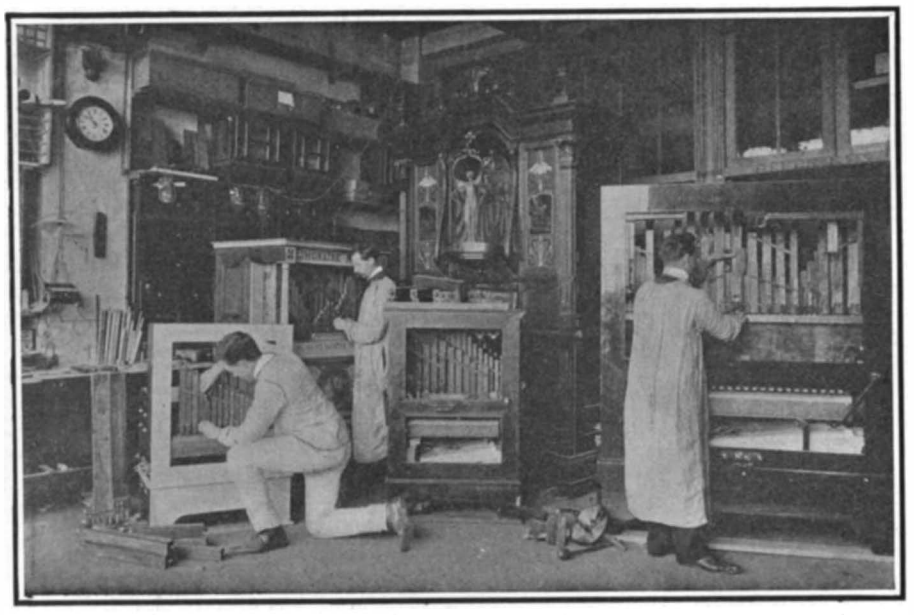
Many of the Limounaire orchestrions have the richness and variety of a complete orchestra and imitate to perfection the sounds of clarinets, flutes, cornets, saxophones, trombones, violins, and violoncellos.

Perforating the Music Sheets by Machine.



Making the Bellows and Wind Chests.

Varnishing Organ Pipes and Finishing Embouchures.



Assembling the Batteries of Pipes.

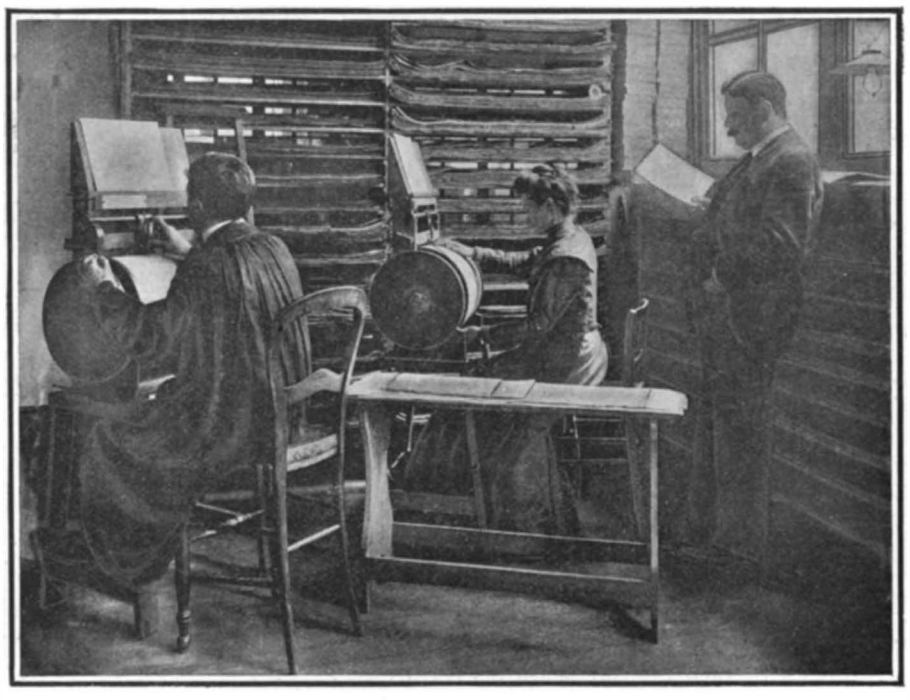
Recent Automobile Races at Ormond and Savannah.

The sixth annual meet on the Ormond-Daytona Beach, in Florida, was held the first week in March, and, although it was not so largely attended as heretofore, the results were, on the whole, satisfactory. The first two days brought forth no startling results, but during the last two days a number of records were broken. The principal race was 256 miles in length. It was for cars weighing not more than 2,424 pounds, and was run over a 16-mile course. The machines in this race consisted of a 60-horse-power Renault racer, a 60-horse-power Fiat, and two Christie cars of 120 and 60 horse-power respectively. For the first 80 miles the big French and Italian cars were closely matched; but the former lost much time owing to tire trouble, and was finally hopelessly behind the Fiat. The larger Christie machine dropped out in the second round owing to a broken porcelain spark plug dropping into the cylinder. The Italian Fiat driven by Cedrino finished in splendid style in 3 hours, 21 minutes, and 27 2/5 seconds. He won the race, therefore, at an average speed of 76¼ miles an hour. He had not been obliged to make a single stop on account of tires, although, when on the first lap, he lost five minutes replacing an igniter. On account of his record-breaking run, Cedrino continued until he had completed 300 miles, which distance was covered in 3 hours, 53 minutes, and 44 seconds—at an average

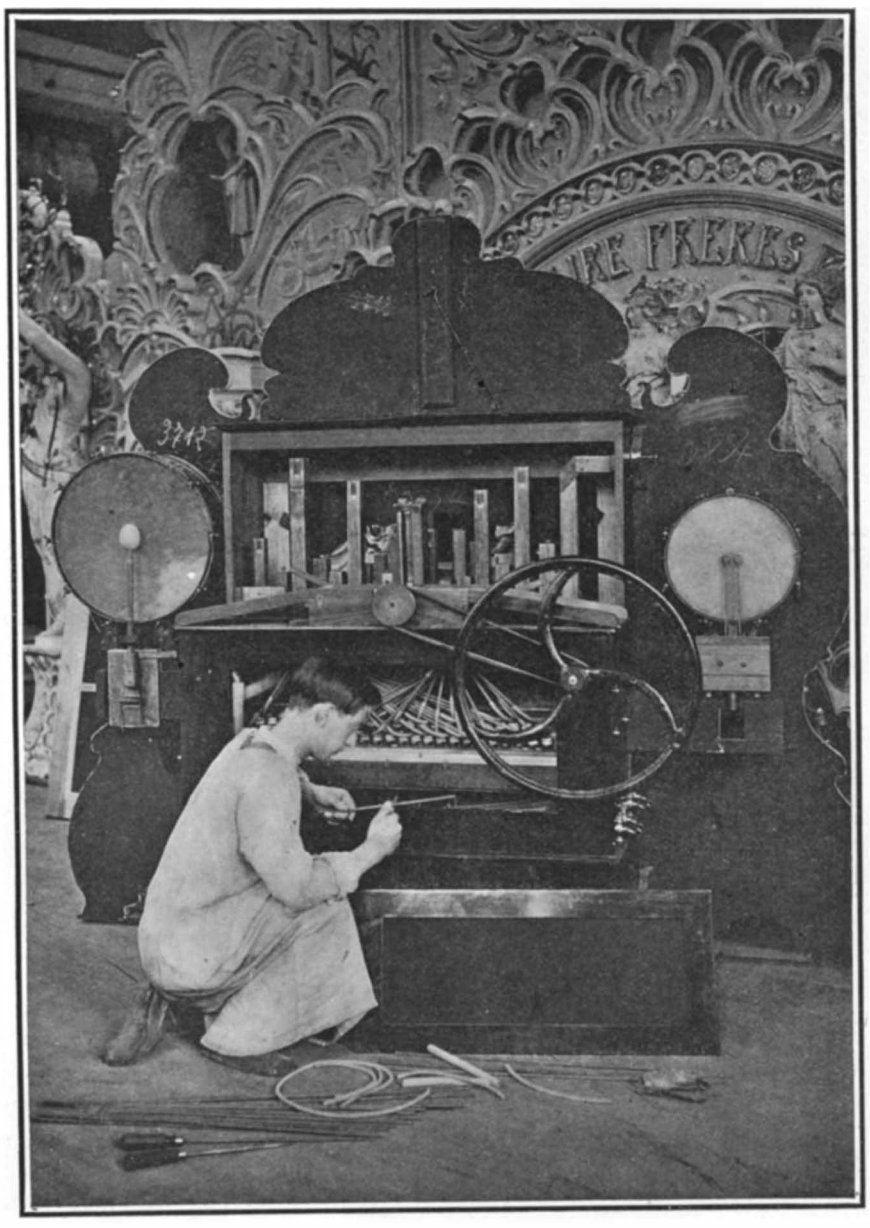
speed of 77 miles per hour, or at a rate of 6.2 miles an hour faster than was attained by the winning Fiat car in the Grand Prix road race in France last summer. The 60-horse-power Christie and the Renault cars finished twelve seconds apart. Their times were 4:06:26 and 4:06:38, respectively. For the first time an American car of distinctive construction won second place from a high-class French racing car. In the above race a new time of 3 hours, 16 minutes, and 48 3/5 seconds was scored for a distance of 250 miles. In a match race the Renault car covered 100 miles in 1 hour, 12 minutes, and 56 1/5 seconds, at an average speed of 82.26 miles an hour. This time was 2 minutes, 44 1/5 seconds better than that made by the Englishman Earp on a Napier car two years ago. New stock-car records for 125 and 150 miles were made by a 60-horse-power Benz machine. These were 1:53:30 2/5 (66.07 miles per hour) and 2:40:33 (56.05 miles per hour) respectively. The mile speed trials resulted in the making of a new record for middle-weight cars by Cedrino's Fiat driven by the Italian. This car covered a mile in 35 seconds, or at the rate of 102.8 miles an hour, while it was afterward driven the same distance in 35 3/5 seconds by David Bruce Brown, a 17-year-old New York school-boy who had never before driven this machine. Mr. Brown thus beat by 3 1/5 seconds the record made by W. K. Vanderbilt, Jr., with his 90-horse-power Mercedes, in 1904. The fast speed made by this machine was remarkable in view of the fact that it was a long-distance car of only 60 horse-power. The record for a gasoline machine is 30 3/5 seconds made by Demogeot on a 200-horse-power Darracq on Ormond Beach in 1906. The only other record that beats it by a car of its type is that of the 80-horse-power Napier (34 2/5 seconds) made in 1905. The same time—35 seconds—was made by Walter Christie in his 100-horse-power car at Atlantic City in 1905. The 60-horse-power Renault car did a mile in 39 1/5 seconds, which is a rate of speed of 91.83 miles an hour.

Following shortly after the Ormond Beach races there was held on a 17.1-mile circuit near Savannah, Ga., on the 19th ultimo, a 342-mile stock chassis road race. This race, which was the first road race to be held in America since the Vanderbilt Cup race of 1906, was also won by an Italian car—a 50-horse-power Isotta-Fraschini—while the second, third, and fourth places went to American cars as follows: 50-horse-power Apperson, time 6:44:37; 50-horse-power Acme, time 6:47:05; 45-horse-power Lozier, time 6:49:17. The winning car covered the total distance in 6 hours, 21 minutes, and 30 seconds, or at a speed rate of 53.78 miles an hour. The fastest lap was made by a car which obtained fifth place in the race—a second 50-horse-power Isotta-Fraschini—in 16 minutes and 46 seconds, or at the rate of 61.19 miles an hour. The last four laps were exceedingly closely contested, and there were four cars that all seemed to have an equal chance of winning second place. These finished only a few minutes apart in the order given. The Acme machine was the only 6-cylinder car in the contest. The course provided was in good condition and all the turns were banked. For the first time in this country, soldiers guarded the course. Despite the precaution of banking the turns, one of the 50-horse-power Apperson machines upset while attempting to pass another car at one of these places. The driver was not injured, although the car was obliged to drop out of the race. The two Italian cars which won, and which obtained fifth place, are looked upon as probable winners in the Briarcliff Trophy race to be held on a circuit in Westchester County on April 24.

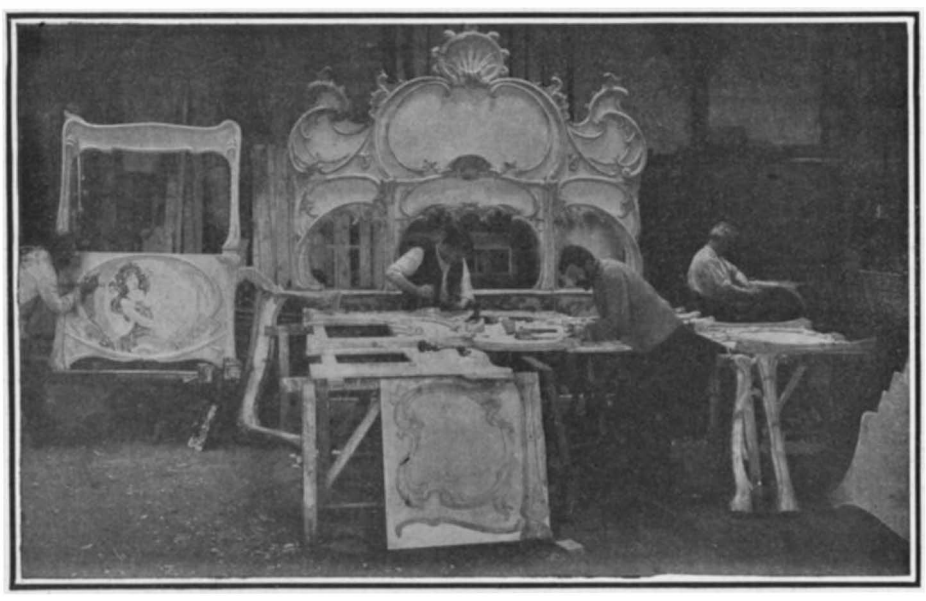
Putting Hoops on Drums and Inserting the Mechanism Into Puppets.



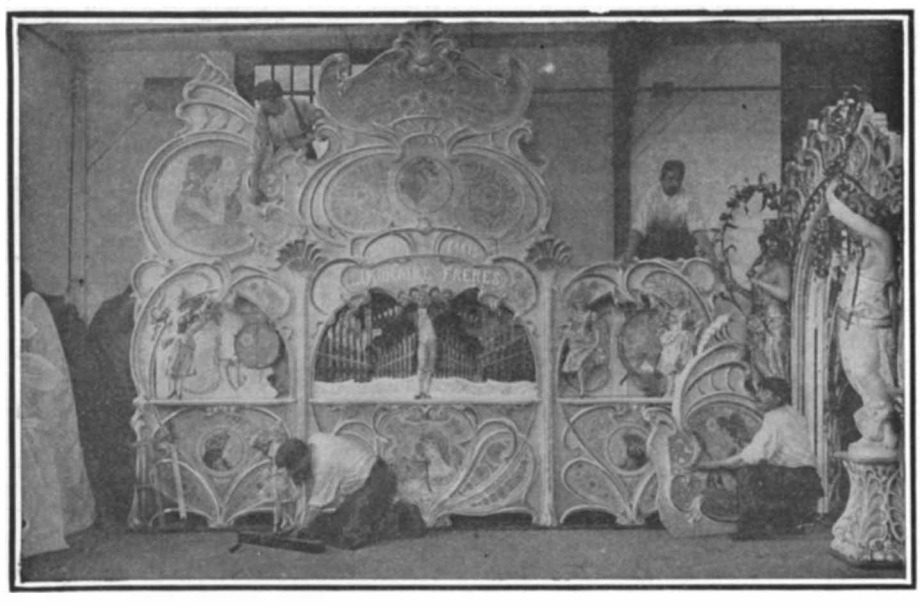
Marking the Notes for Perforation.



The Back of a Small Orchestrion Opened for Adjustment of Certain Parts.



Carving and Decorating the Woodwork.



Setting Up the Front of a Large Orchestrion.

THE MANUFACTURE OF MECHANICAL ORGANS.

SATURN'S RINGS.

BY DR. S. A. MITCHELL, COLUMBIA UNIVERSITY.

It is now forty-five years since there has been so good an opportunity as these past few months have brought for viewing the rings of Saturn turned edge-on to the earth, when according to calculation, they have been invisible. In this interval all the great telescopes of the world have been constructed. Moreover, in 1895 Keeler, by a magnificent application of the spectroscope, proved that the rings were not a solid disk 170,000 miles across and 100 miles thick, but were composed of millions of small meteorites or satellites, each moving about the planet in obedience to the law of gravitation. Thus with new and gigantic telescopes, and a better understanding of the constitution of the rings, astronomers have again attacked the problem with renewed interest, in order to settle some important questions regarding the appearance and conservation of this beautiful and unique ring system.

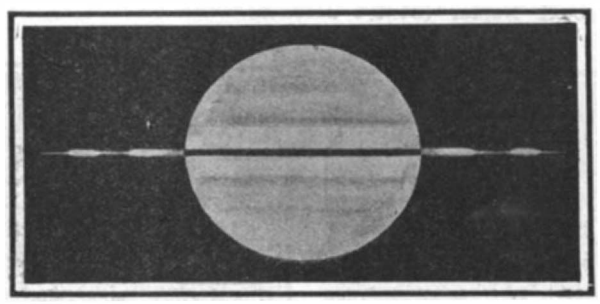
As is well known (see SCIENTIFIC AMERICAN, November 30, 1907) the rings once every fifteen years are narrowed down to a thin line of light, and practically become invisible even in our largest telescopes. In three separate positions they may disappear from view: First, if the plane of the rings passes through the earth, we can see their edge only, which at the distance of nine hundred millions of miles that we are from Saturn subtends such a very small angle (1-40 of a second of arc) that for a few hours the rings become entirely invisible even in the Yerkes telescope. When the plane of the rings passes through the sun, their thin edge only is illuminated, and for a second time they would be invisible. Since they shine by reflected sunlight, manifestly it should be impossible to see them when the sun and earth are on opposite sides of the plane of the rings, and we have thereby a third position of disappearance. Since 1891, both the sun and the earth were on the north side of the rings up to April 17, 1907, when the earth passed through the plane of the rings, leaving the sun on the north side. On this date the rings were lost from view, but the disappearance could not be seen from the earth as the planet was then too near the sun to be well seen. From this date until July 26 the ring was supposed to be invisible, the sun and earth being on opposite sides of the ring. On July 26 the sun also passed to the south, and the ring became bright from reflected sunlight and remained so till October 4, when the earth once more passed to the north, and with the sun and earth on opposite sides, the ring system for a second time theoretically disappeared. On January 7, 1908, the earth again crossed to the south side, and as the sun was already there, the sunlit position of the ring will be visible for the next fifteen years. Thus on the four dates, April 17, July 26, October 4 and January 7, the plane of the rings passed through either the sun or the earth, and for a few hours they probably disappeared from view even in our largest telescopes. But instead of being invisible from April to July and from October to January, as might be expected, the rings were seen, but with condensations or knots in them. These knots on Saturn's rings have led to some very interesting speculation regarding the shape of the rings, and in the estimation of some astronomers these knots are the forerunners which point the way to the ultimate destruction of the ring system.

At the times of disappearance of the rings in 1891 and also in 1878, Saturn was much too near the sun to be satisfactorily observed, and thus it was as far back as 1861-62 that the last favorable opportunity was had to observe the rings when turned edgewise to the earth. But instead of disappearing from view in these years, when the sun and earth were on opposite sides of their plane, the rings were readily seen, but with luminous appendages on them, practically the same as during the past few months.

Sixty years ago, in 1848, the conditions for the disappearance and reappearance of the rings were about the same as those in the present year. In that year from April to September 3, and from September 13 to January 19, 1849, the earth and sun were on opposite sides of the rings. In Vol. II. of the Harvard College Observatory Annals, G. P. and W. C. Bond give a great number of drawings, which show the same knots or condensations and essentially as they have appeared in 1861 and in 1907-08. Thus it would appear that the rings have not changed to any noticeable degree in these past sixty years, and the disintegration which theoretical considerations tell us the rings are undergoing, is not proceeding at a very rapid pace. We see the rings now as our grandfathers saw them, and there is not the least shadow of a doubt that our grandchildren will be deprived of this beautiful system of Saturn and his rings.

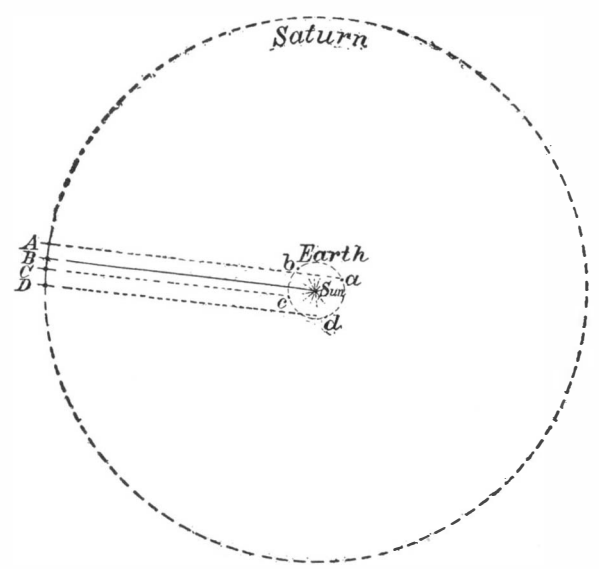
The knots or appendages are thus a permanent feature of the rings, which come into view when the sun and earth are on opposite sides of their plane. How is it that we can see the rings when there is no direct sunlight shining on them? What sort of light illuminates the dark side of the rings? And what is the real meaning of the knots?

In a very interesting communication to the Royal Astronomical Society, Prof. Barnard gives a very rational explanation of these phenomena. Knots in Saturn's rings seem to have been seen first in 1907 at the Yerkes Observatory by Prof. Barnard on July 2, and about the same time at the Lick and Lowell observatories. Though no direct sunlight was then shining on the rings, they could nevertheless be seen to their full extent as a slender line of light on each side of the planet. Symmetrically placed with respect



View of Saturn on the 12th of December, 1907.

to the planet were two condensations on each side, ill defined, more or less diffused, and seemingly thicker than the rings, extending the inner 1.10-1.46 and the outer 1.72-1.92 from the center of the planet. The condensations were quite bright and noticeable. They disappeared before July 26, when the earth passed through the plane of the rings, and were invisible in the period July 26 to October 4, when the sunlit side of the rings was turned toward us. These knots were again seen by Prof. Barnard on October 13, and were



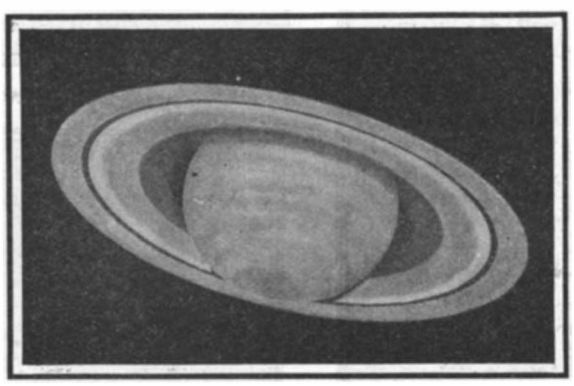
Orbits of Saturn and Earth in 1907 and 1908.

Drawn to scale by Barnard.

A, *a*, positions on April 17, 1907; *B*, *b*, on July 26; *C*, *c*, on October 4; *D*, *d*, on January 8, 1908.

readily visible through October, November, and December. The illustration which shows Saturn on December 12 should be placed at a distance of about 30 inches in order to get the correct appearance when seen in a powerful telescope. Before January 8 the condensations vanished, and they are now no longer to be seen.

Before taking up the question of the knots, it might be well to try and show why the rings were visible at all from April to July and from October to January



Saturn as Seen Through a 4-Inch Telescope on July 7th, 1898.

SATURN'S RINGS.

when we were looking at their dark side. The natural assumption might be that they were illuminated by light reflected from Saturn, the planet acting like a big moon. Sixty years ago Bond showed this to be an impossible explanation. Then it was thought that they might be luminous from some sort of a twilight effect, but this idea too was untenable. With the rings regarded as a solid whole, no explanation seemed satisfactory; but with the recognition of their minute structure, made up of thousands and millions of little satellites, the difficulties readily vanish. As is pointed out by Prof. Barnard, the particles that make up the rings are not packed so closely together that they are impervious to sunlight, but the sunlight sifts through and is scattered around the bodies, so that the rings become visible even when viewed from the dark side. In the dusky crepe ring the particles are few and far between, for the planet itself can be seen with undiminished splendor through the crepe ring when the rings are opened wide. In the outer ring the particles are more closely packed together, much less light is transmitted through them, but seen from the dark side more light is reflected than from the crepe ring, on account of the greater number of bodies to reflect the light. The outer fourth of the inner ring is brightest under ordinary circumstances, and also brightest when sun and earth are on opposite sides of the ring.

The condensations have been explained by Prof. Lowell (SCIENTIFIC AMERICAN, December 14, 1908) to be due to the rings departing from the plane, that they are not flat, but are of the nature of tores or flattened anchor rings. This explanation seems a perfectly natural one, and satisfies all appearances except at the critical times of October 4 and January 8, when the rings were turned directly to the earth. If the rings were in the shape of tores, they should have shone out with much greater luster on these crucial dates than at other times, but, though specially watched for, the condensations were utterly invisible!

Thus it does not seem that there is any reason to suppose that the rings are not everywhere flat. On this assumption, pushing Prof. Barnard's explanation a little bit further, we arrive at a very satisfactory theory of the knots. Micrometric measures of their positions show that the center of outer condensations falls just inside the Cassini division in the rings. Sunlight falling through this division, which is comparatively free from particles, onto the densest portion of the whole ring system, would probably make the knots or condensations appear as they have in the past few months when viewed from the dark side. On this explanation the Cassini division would have to be regarded as more or less filled with particles, probably as dense as in the crepe ring. This is contrary to the generally accepted theory, that the action of certain of the satellites would not permit particles to remain in the Cassini division. The inner condensations are explained by a similar illumination of the crepe ring. By a peculiar coincidence, Rev. T. E. R. Phillips, of England (Nature, January 7, 1908) explains in an exactly similar way the visibility of the rings.

Prof. Barnard is of the opinion that the knots are in reality no thicker than the rings, but appear thicker due to irradiation. He is led to this conclusion because the condensations disappear when the rings are on edge—when they should be most conspicuous if tores—and second because he has reproduced the same irradiation effect in a series of drawings sent to the Royal Astronomical Society, by simply darkening the ring around the positions of the condensations without changing at all its outline.

The explanation of Prof. Barnard does not call for any radical change in our ideas of the constitution of the rings of Saturn and it seems to be by long odds the best theory that we have.

The Periodic Comets Expected in 1908.

Four periodic comets are expected to make their perihelion passages this year. One of them has already made its appearance, having been seen as a telescopic object of the twelfth magnitude in the constellation of Pisces, by Prof. Wolf, of Koenigstuhl, on January 2. This is the well-known Encke's comet, the orbit of which lies entirely within the orbit of Jupiter. After its discovery by Pons in 1818, Encke calculated its period and successfully predicted its reappearance in 1822. Since that date it has appeared regularly at intervals of about three and one-third years, and earlier appearances have been traced in astronomical records back to 1786. Encke found that, after allowance had been made for the considerable disturbing effect of the planets, particularly Jupiter, a progressive diminution of the periodic time, amounting to two and two-thirds days in each revolution, remained. He attributed this regular acceleration, which is confirmed by all later observations, to the action of a resisting medium diffused through the interplanetary space.

Another comet expected this year was first observed by Temple in 1869. Its period (five and one-half years) was calculated by Swift after its appearance in 1880. It reappeared in 1885 and 1891, but was not seen either in 1897 or 1903.

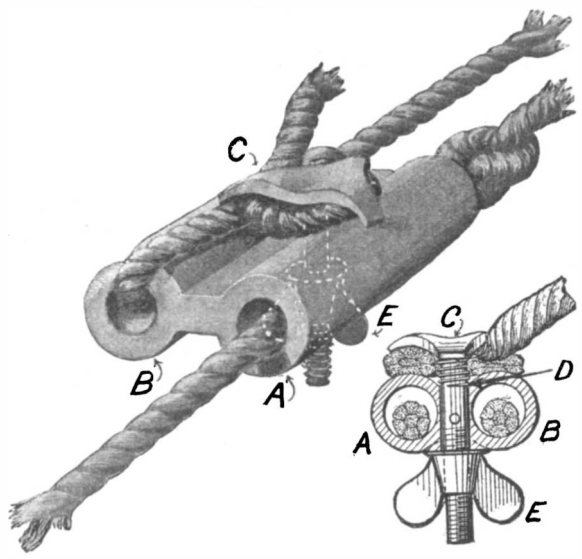
Denning's comet was first observed in 1881. It has a period of about eight years and should reach its perihelion in 1908.

The fourth expected visitor is the comet discovered by Giacobini in 1900. If its calculated period, of about seven years, is correct, it should make its appearance very soon. As it has been seen only once, it cannot strictly be called a periodic comet.

Patent Department

SIMPLE CLAMP FOR CLOTHES LINES.

A very simple clamp for clothes lines is illustrated in the accompanying engraving. The device can be readily manipulated to fasten together the two ends

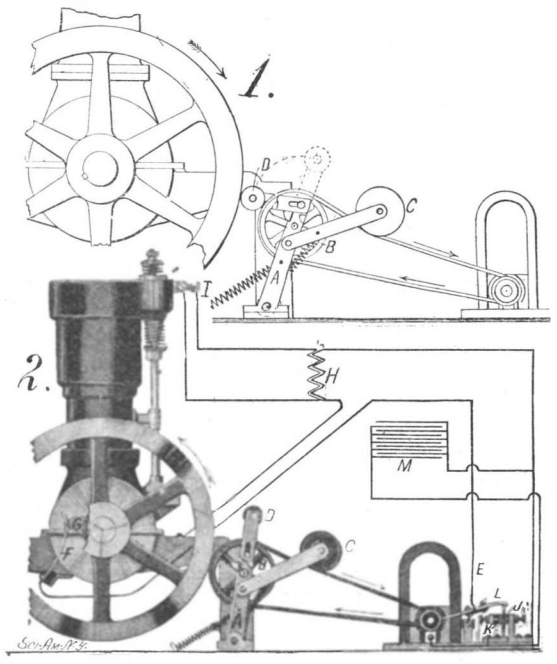


SIMPLE CLAMP FOR CLOTHES LINES.

of a clothes line. The construction of the clamp is such, that when applied to a line there will be little danger of its slipping from its set position, and it may be readily tightened or loosened, as occasion may demand. The clamp consists of two parallel barrels *A* and *B* connected by a web. These barrels are open at both ends. In the center of the web is an opening adapted to receive a bolt *C*. The bolt hole is provided with a keyway, in which a pin fitted in the bolt is received. This prevents the bolt from rotating with respect of the web, but permits it to slide axially therein. The bolt head is formed with wings preferably three in number, which are bent downward. A spring *B* is coiled about the shank of the bolt beneath the head, and serves to space the latter above the web. Threaded on to the bolt and bearing against the under side of the web is a wing nut *E*. The method of applying the clamp is very simple. One end of the rope or clothes line is passed through one of the barrels, and knotted to prevent it from slipping out. The opposite end of the line is then passed through the other barrel, and the end is wound around the bolt under the concave face of the head. A few turns of the wing nut *E* then serve to clamp the head *C* on the rope, and hold it in set position. Mr. William Mullin, of 3106 Third Avenue, New York, N. Y., is the inventor of this improved clothes line clamp.

GAS ENGINE IGNITER.

A new igniting apparatus has recently been invented for use in internal combustion engines, which is calculated to do away with the vibrator on the spark coil of the conventional jump-spark system of ignition. The coil is supplied with current from a magneto driven frictionally by the flywheel of the gas engine. On the engine base close to the flywheel an arm *A* is pivoted. Mounted on this arm is a pulley B, which is belted to the armature shaft of the magneto. A spring-pressed pulley *C* serves to keep the belt taut. A third pulley *D* is mounted on an arm pivoted to the arm *A*. When this pulley is swung downward against the flywheel



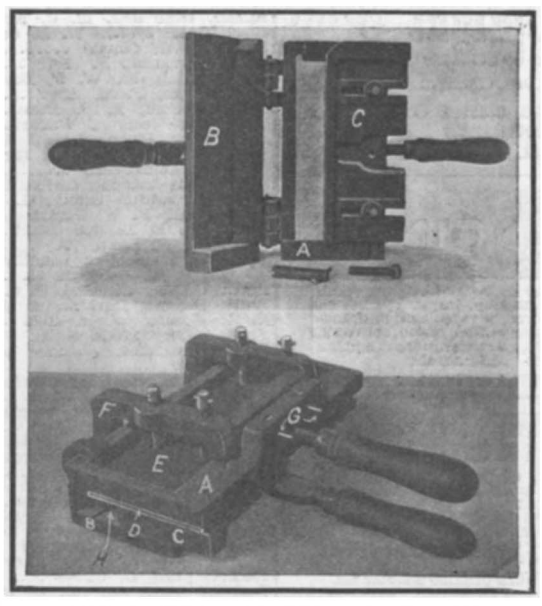
GAS ENGINE IGNITER.

and the pulley *B*, if the flywheel rotate counter-clockwise, the pulley will not interfere with the frictional engagement of the belt and flywheel, but if the flywheel turn in the opposite direction, the idler *D* will force itself between the flywheel and the belt, and cause the latter to continue its motion in the same direction. Thus a constant direction of rotation of the magneto armature is assured. The energy generated by the magneto is conducted by means of a wire *E* to a brush *F*, which engages a contact *G* on the engine frame. Thence the current passes to the primary winding of the induction coil *H*, and returns to two contact points *J* and *K* on the magneto frame. A rod *L* connected to an eccentric on the magneto shaft serves to mechanically vibrate a contact spring between the points *J* and *K*, with the result that the current is twice interrupted at each complete revolution of the armature shaft. The secondary of the induction coil *H* leads to the spark plug *I*, and the coil is provided with a condenser *M*. In starting the engine, it is often necessary to give the crankshaft a few turns in the reverse direction; but this ordinarily involves a rotation of the magneto also in the reverse direction. By the arrangement here shown, the idle pulley *D* serves to transmit the power to the magneto, always in the proper direction regardless of the direction of rotation of the flywheel.

Mr. Albert N. Classon, of 93 Thirty-third Street, Chicago, Ill., has recently patented this system of ignition.

CASTING TOOL FOR PRINTING OFFICES.

Pictured in the accompanying engraving is a tool adapted for molding borders, rules, dashes, etc., and hence should be found quite useful in printing offices. By a slight interchange of parts the tool may also be used for forming leads, slugs, and metal furniture. The tool is quite simple, consisting of two mold sections *A* and *B*, provided with handles. The section *A* is an open frame approximately rectangular in shape.

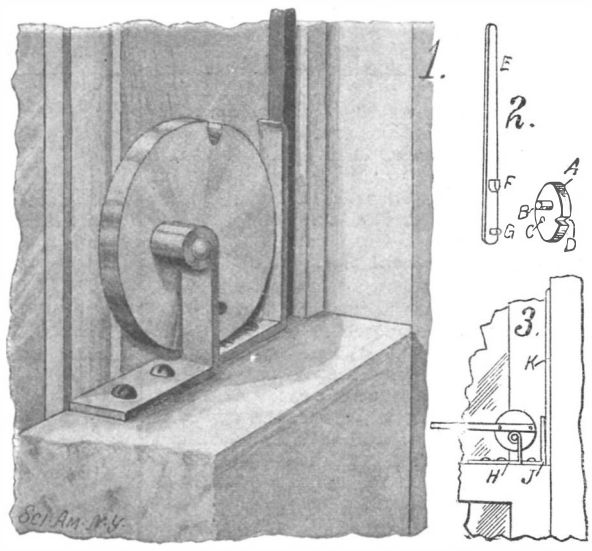


CASTING TOOL FOR PRINTING OFFICES.

The section *B* consists of a plate formed with an upwardly-extending flange on two of the sides. In addition to the two mold sections, a plate *C* is provided, which is formed with two downwardly-extending flanges adapted to bear on the plate *B*. At *D* a filling strip is shown. The two mold sections are hinged together, and extending over section *A* is a frame *F*. This is provided with four pressure screws, adapted to bear against a platen *E* set in the open frame *A*. The frame *F* is fastened to section *A* by pins *G*. In use, if it be desired to form a rule or border, the latter is placed between the flanges of the section *B* and member *C*. The space between these flanges may be varied at will. A piece of prepared matrix paper is laid over the rule or border. This is then covered with a layer of felt, after which the two mold sections are clamped together, and the platen is forced downward by tightening the pressure screws. In this way an impression of the article to be cast is obtained. After removing the article, the tool is closed, and metal is poured into the open end *H* of the mold, and the cast is made. The inventor of this casting tool is Mr. Howard Goddard, of Canton, Ohio.

IMPROVED SASH LOCK.

The advantages claimed for the sash lock herewith illustrated are that it will securely lock both sashes at any desired position in a window frame, and that when set it cannot be unlocked without the use of a special implement. Hence the window is made proof against sneak thieves or burglars, because the sashes cannot be unlocked after breaking the glass, by passing the hand through the window to the lock. The device is exceedingly simple, consisting of a cam or eccentric disk *A* mounted on the lower sash, and pressing against an iron bar carried by the upper sash directly in front of the parting bead. The disk *A* is provided with a pin *B* at one side, and a notch *D* in the periphery at the opposite side. The disk is mounted to turn on a shaft *C* secured in a bracket, *H*. In order to turn the cam, a lever *E* is furnished, which is formed with a lug *F* adapted to engage the pin *B*, and a pin *G* adapted to enter the notch *D*. This rod when applied to the cam provides a long leverage, by which the cam may be rotated on its bearings, and made to press against the iron bar carried by the upper sash. In order to prevent the sashes from mov-

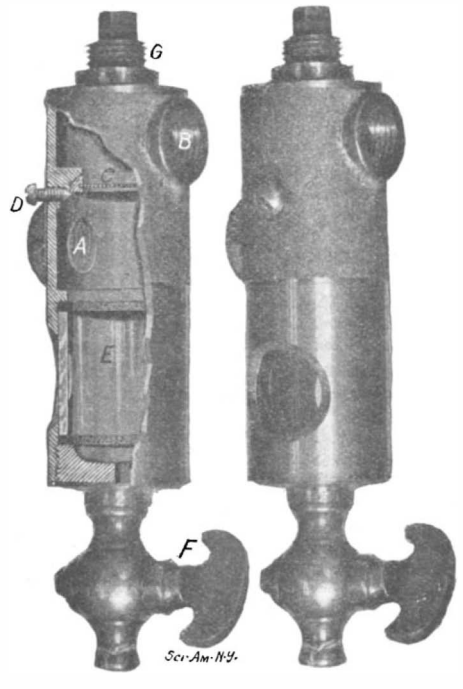


IMPROVED SASH LOCK.

ing with respect to each other, owing to frictional contact with the periphery of the cam while the latter is being turned, a spring piece *J* is provided on the lower sash, which projects between the cam and the bar *K*. Once the sash has been locked, the lever *E* is removed, and it is then impossible to turn the cam. The inventor of this sash lock is Mr. Jesse H. Barton, of Brownsville, Tenn.

AN IMPROVED GASOLINE TRAP.

The invention illustrated herewith is adapted to be used in connection with gasoline supply pipes or carbureters, and is designed to facilitate the separation of sediment, water, and other impurities in the gasoline, before the latter is vaporized in the carbureter or engine. The arrangement is such that impurities are strained out of the gasoline, and collect at the bottom of a special chamber, the sides of which are transparent, so that the amount of water and sediment collected may readily be ascertained and drawn off through a stopcock at the bottom. In our illustration, the inlet pipe is shown at *A*, and the outlet pipe at *B*. The gasoline entering the pipe *A* fills the trap, and is obliged to flow through a screen *C* before it can reach the outlet pipe *B*. The screen is mounted in a ring formed with a beveled edge, and the pointed ends of a pair of set screws, *D*, engaging this beveled edge, hold the ring against its seat in the casing of the trap. The lower part of the trap is fitted with a glass tube, and is provided with a pair of sight openings, which permit of ascertaining the quantity of sediment collected in the trap. The lower end of the trap is closed by a plug fitted with a stopcock *F*, through which the sediment is drawn off. Aside from the outlet pipe *B*, an opening is provided in the top of the trap, in which a second outlet pipe may be fitted. This opening is normally closed by a plug *G*. The inventor of this improved gasoline trap is Mr. William J. Kramer, 246 Van Alst Avenue, Long Island City, New York.



IMPROVED GASOLINE TRAP.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

CORSET.—MARTHA SCHOTTLANDER, New York, N. Y. The purpose of the invention is to reduce and support the abdomen, giving a straight front to the body and graceful and symmetrical lines to the hips, thus providing a foundation for a perfect-fitting gown. This is attained by providing the corset near the bottom front thereof with an adjustable strap, the extreme ends of which are each attached to diverging cords or lacings, having a slidable connection with the corset near the sides and thence extending in opposite direction to the forward portion of the corset, where they are attached.

SHOE-LACE FASTENER.—G. H. NICHOLLS, Galveston, Tex. In the present patent the invention embodies an improvement consisting mainly in a clamp applied to the head of a stud, and adapted to close upon a shoe-lace passed through the opening in the head of the same. It is an improvement on the application formerly filed by Mr. Nicholls.

Electrical Devices.

CONTACT APPARATUS FOR ELECTRIC IGNITERS.—J. KRANNICHFELDT, Cologne, Germany. The invention relates to magnetic induction apparatus or dynamo apparatus for firing electric igniters such as are used for blasting purposes in connection with mines, and the objects are to prevent the circuit of the igniters being closed until sufficient current is generated to fire all the igniters and to close the circuit of the igniters without occasioning any vibrations.

Of General Interest.

CONSTRUCTION OF BUILDINGS.—C. H. WILSON, Red Oak, Iowa. This structure consists of a filling of plastic material and a facing of molded plastic blocks, each of the blocks containing a reinforce comprising horizontal and vertical bars, and each of the bars is provided at one end with a pair of ears and at the other with a lug adapted to be received between the ears of a bar in the adjoining block, the lugs and the ears being connected together to form a plurality of continuous vertical reinforces and a plurality of horizontal ones in the facing, the facing being suitably tied to the filling.

REEL FOR RUCHINGS, ETC.—L. SONN, New York, N. Y. In this case the invention pertains to packaging fabrics, and its object is to provide a new and improved reel which is simple and durable in construction, exceedingly strong, and more especially designed for winding thereon ruchings and other fabrics.

CANAL-LOCK.—S. S. JAMISON, Saltsburg, Pa. The invention avoids loss of water from the emptying of the lock chamber to a lower level at each locking. In saving, it provides for the passage of the water in one chamber to the other so that if one is full, the other empty, and it is desired to raise a boat from the lower level and to lower a boat from the upper, it may be passed from the latter to the full chamber and from the lower level to the empty chamber, the gates closed and the water permitted to pass from the full to the empty chamber, thus lowering the boat in the full chamber and raising it in the previously empty one.

Pertaining to Recreation.

FISH-BAIT.—H. D. KLEIN, Butternut, Wis. The aim of the improvement is to provide a durable fish bait provided with a plurality of hooks, and a spinner adapted to receive a rotary motion in the water to attract the fish, and which is adapted to be used in connection with an artificial wooden minnow, or live bait such as a minnow, a frog, and the like.

Pertaining to Vehicles.

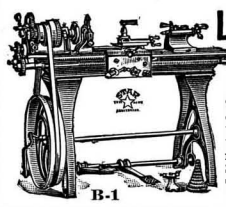
TRICYCLE.—N. LARSON, Agra, Kan. The object in this instance is to provide a construction which is furnished with means for propelling it by foot and by hand. Further, to provide a tricycle having spur gear transmission and means for effectively braking upon the crank shaft by means of which the foot and hand power is transmitted, and in which the wheels are laterally adjustable to the width of the path.

MIRROR FOR MOTOR-VEHICLES.—H. CAIN, Paris, France. By the use of this mirror the chauffeur may see the road behind the vehicle, and, at the same time, the road in front. The invention relates more particularly to the special means for mounting the mirror so that it takes up the minimum amount of space and does not detract from the appearance of the vehicle.

VEHICLE-SPRING.—J. S. CLARK, Island City, Ore. One purpose here is to furnish a supplemental spring for use upon spring vehicles that will act as a buffer and reinforcing spring, preventing the springs from bumping together or breaking when overloaded, and at the same time adding any given amount to the carrying capacity of the springs without impairing their elasticity and ease of vibration when under a normal load.

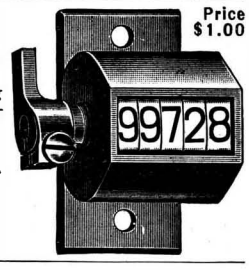
TIRE-PROTECTOR.—H. M. BRADLEY, Fort Worth, Tex. This invention pertains to vehicle wheels having pneumatic or solid rubber tires, and the object of the invention is to provide a new and improved tire protector, arranged to prevent the tire from being punctured, at the same time preventing skidding of the wheel on a slippery roadway.

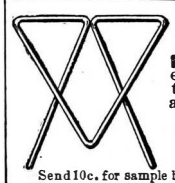
NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.


LATHES THAT LAST
and give thorough satisfaction are the celebrated
STAR Foot or Power LATHES
9 to 16 inch swing, with forged crucible steel hollow spindles and phosphor bronze bearings. High grade throughout. Suitable for all lines of machine shop and tool room service. Send for catalog B.
THE SENECA FALLS MFG. CO.
695 Water St., Seneca Falls, N.Y.

Engine and Foot Lathes
MACHINE SHOP OUTFITS, TOOLS AND SUPPLIES. BEST MATERIALS. BEST WORKMANSHIP. CATALOGUE FREE
SEBASTIAN LATHE CO., 120 Culvert St., Cincinnati, O.

Foot and Power and Turret Lathes, Planers, Shapers, and Drill Presses.
SHEPARD LATHE CO., 133 W. 2d St. Cincinnati, O.

Veeder Counters
Price $1.00
to register reciprocating movements or revolutions. Cut full size.
Booklet Free
VEEDER MFG. CO.
18 Sargeant St.
Hartford, Conn.
Cyclometers, Odometers, Tachometers, Counters and Fine Castings.



THE CLIPPER CLIP
Its triangular shape prevents entangling and gives three times the capacity of any other Clip for attaching papers together.
Best & Cheapest. All Stationers.
CLIPPER MFG. CO.,
New York City
Send 10c. for sample box of 100; or 20c. for clips and desk tray.

PATENTS
Our Hand Book on Patents, Trade-Marks, etc., sent free. Patents procured through Munn & Co. receive free notice in the
SCIENTIFIC AMERICAN
MUNN & CO., 361 Broadway, N. Y.
BRANCH OFFICE: 625 F St., Washington, D.C.

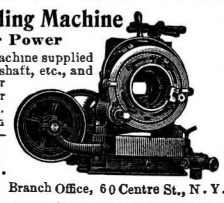
THE "BARNES"
Positive Feed
Upright Drills
10 to 50-inch Swing
Send for Drill Catalogue.
W. F. & JNO. BARNES CO.
(Established 1872)
1999 Ruby St., Rockford, Ill.
TRADE W.F. & J.B. MARK

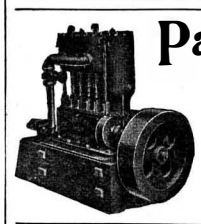
DEAN ENGINES
GAS-GASOLINE-ALCOHOL

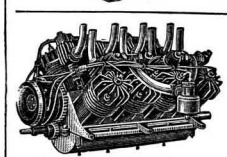
We offer more real engine value for your money, larger cylinders, more power, service and satisfaction than any other manufacturers. Our catalog explains it, our guarantee confirms it and our sales prove it. Address the
DEAN GAS ENGINE & FOUNDRY CO. 110 Front St. Newport, Ky.

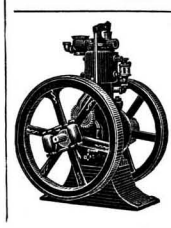
THE ROCKFORD
14-INCH DRILL
is adapted for work from 1-16 inch to ¾ inch. A strong, substantial, well built drill. Plain lever or power feed as desired. We build a full line of Drills. All sizes furnished in Gangs. Also have 9-in., and 11-in. Screw Cutting Lathes, and a 24x2-in. Wet Tool Grinder. Catalog S on request.
ROCKFORD DRILLING MACHINE CO.
Successor to R. F. Barnes Co. Rockford, Ill.
European Branch, 149 Queen Victoria St., London, E.C.

DO YOU USE GRINDSTONES?
If so we can supply you. All sizes mounted and unmounted, always kept in stock. Remember, we make a specialty of selecting stones for all special purposes. Send for catalogue "L."
The CLEVELAND STONE CO.
2d Floor, Wilshire, Cleveland, O.

Pipe Cutting and Threading Machine
For Either Hand or Power
This machine is the regular hand machine supplied with a power base, pinion, countershaft, etc., and can be worked as an ordinary power machine or taken from its base for use as a hand machine. Pipe ⅛ in. to 15 in. diameter handled easily in small room. Illustrated catalogue—price list free on application.

THE CURTIS & CURTIS CO.
6 Garden St., Bridgeport, Conn. Branch Office, 60 Centre St., N. Y.


Palmer Motors
Two and Four Cycle. One, Two and Four Cylinder. Stationary and Marine. One to Twenty H. P. Catalogue FREE.
PALMER BROS., Cos Cob, Conn.
New York: 30 East 20th Street
Philadelphia: The Bourse
Boston: 85 Union Street
Portland, Me.: Portland Pier
Seattle, Wash.: Colman Dock


Motors
for airships and other purposes where light and powerful engines are required.
1 to 40 H. P. Air Cooled.
50 & 100 H. P. Water Cooled.
Adopted by War Department. Send for catalogue B.
G. H. CURTISS MANUFACTURING CO.
Hammondsport, N. Y.


THE GARDNER
1 H.P. Gasoline Engine
can be used for any power purpose. It is safe, simple and economical to operate. Can be installed any place and requires very little attention. We build all sizes for any purpose. Write at once for prices and printed matter. Enclose stamp to insure a prompt reply.
GARDNER MOTOR CO.
5011 Delmar Ave., St. Louis, Mo.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending March 24, 1908.

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Ahrading or polishing machine, J. J. Canavan 882,665
Account register, F. F. Dorsey 882,817
Accounting appliance, J. E. Wildman 882,856
Acid by means of superheating, etc., manufacturing nitric, H. Pauling 882,958
Acid glycerin esters, manufacture of salicylic, C. Sorger 882,590
Adding machine attachment, H. R. Wellman 882,806
Adjustable bracket, W. G. Kirchhoff 883,138
Adjustable chair, L. C. Wentworth 882,983
Advertising indicator, C. E. Johnson 882,640
Air brake, W. V. Turner 882,918
Alarm, H. Irwin 883,025
Amalgamator, J. P. McGinn 883,117
Animal trap, A. A. Hamilton 882,755
Animal treating apparatus, F. C. Goff 883,132
Announcing or station indicator for railways and street cars, Gunter & Welton 882,675
Arm supporter, adjustable, C. H. Dingman. 884,004
Audiphone, O. J. Davy 883,003
Automobile frames, bearing for supporting radiators in, P. W. Noble 883,146
Automobile, six-wheeled logging, N. F. Coffey 882,998
Axle, Zahnter & Kunzmann 882,773
Axle, Zachow & Besserdich 882,986
Baling press, E. H. McMurry 883,145
Basket, M. A. Engel 882,935
Bath tub heating device, T. B. Jarvies 882,689
Battery. See Storage battery.
Beach chair, foldable, T. Krech 882,948
Bed, invalid, C. T. Joslin 882,641
Bed spring, H. W. Pennepacker, reissue .. 12,768
Bed warming device, W. H. Proctor 882,714
Beer cooling and purifying apparatus, V. F. Boehm 882,862
Bell, swinging, W. P. & W. P. Elliot, Jr.. 882,780
Bicycle, water, J. L. Henry 883,018
Binder frame, F. Greiner 882,880
Binder, loose leaf, M. C. Neuner 883,042
Block signal system, F. B. Corey 882,553
Blowpipe, G. Claude 882,997
Boat, submarine, F. Mott 883,040
Bolt heading die, W. F. Dowerman 882,628
Bonding pin, F. H. Ayer 882,609
Book, indexed, A. F. Dean 882,816
Book, loose leaf, A. Watters 883,154
Book, manifolding sales, C. M. Kirkland .. 882,568
Boots and shoes, pattern for cutting out, J. J. Dumonceau 882,749
Boring and finishing device, T. W. Green. 883,133
Boring apparatus, safety, G. Burnside 882,741
Boring mill, F. W. Parker 882,580
Bottle, G. E. Zeigler 882,809
Bottle, N. G. Burke 882,864
Bottle cap, combined metallic and frangible, F. T. Robinson 882,912
Bottle capping machine, S. C. Bond 883,127
Bottle cleaning machine, A. A. Pindstofte. 882,962
Bottle closure, W. H. Reid 882,840
Bottle filling machine, L. Strebel 882,849
Bottle receptacle, folding milk, W. S. Weaver 882,854
Bottles, glass holding attachment for, W. K. Hopkins 882,636
Bowling alley, W. W. Vearing 882,851
Box fastener, J. A. Haugh 882,881
Box lid support, N. H. Priley 882,713
Brake head, Gosnell & Harris 883,012
Brazing, W. E. Gleissner 883,011
Bread and making same, C. E. Wait 882,852
Bridle bit, H. H. MacNiven 882,791
Broom moistener, L. G. Egger 882,934
Brush, adjustable cleaning, R. T. Gillespie 883,108
Brush holder, F. B. Howell 882,565
Bucket, clam shell, A. Ruetschi 882,844
Bucket, grab, C. Chase 882,666
Building block and manner of assembling, R. A. Harris 882,633
Bung, valve, A. Schaper 882,652
Bunsen burner, G. Barthel 882,611
Burglar alarm, C. Liaci 882,570
Butter, etc., machine for cutting, J. H. Maurer 883,037
Cable-laying machine, G. W. Noble 882,649
Cable reel, E. Rosenberg 882,587
Calculating machine, W. F. Hausstein 882,560
Calculating machine, W. L. E. Keuffel 882,567
Calculating machine, C. M. Bernegau 882,614
Calculating machine, W. F. Hausstein, 882,679, 882,680
Can cap placing apparatus. J. T. Wilmore 882,728
Can cap placing machine, W. I. White 882,603
Cap for the protection of the human head, Ireland & Cole 882,686
Car coupling, A. Klinglesmith 882,696
Car door hanger, T. S. Merriman 882,950
Car, dumping, A. G. Brown 882,621
Car, railway passenger, T. R. Brown 882,927
Car, tram, J. J. Schimpf 882,915
Cars or trains, system for automatically stopping, E. E. Kleinschmidt 882,695
Cars, steel underframing for railway, F. L. Irwin 882,638
Carcass scrubber, C. L. Smith 882,719
Carpenter's tool, combined, B. Jacob 883,112
Carpet fastener, J. C. F. Borger 883,129
Carpet stretcher, T. E. Davis 882,873
Carriage, baby, J. E. Loshbough 882,901
Carriage, child's, A. W. Loshbough 882,900
Carriage, folding baby, J. E. Loshbough. 882,902
Carving machine, F. H. Richards 882,842
Castings, producing chilled, M. J. Somers. 882,720
Cellulose, method and apparatus for producing, A. Muntzing 882,790
Cement post, C. Hornshaw 883,022
Chain galvanizing machine, E. C. Bull 882,776
Chamber, extensible, P. G. Hubert 882,760
Chandelier, W. T. H. Pauley 883,045
Cheese press, E. L. McKinnon 882,792
Chocolate making machine, W. E. Murray 882,646
Chopper. See Cotton chopper.
Chuck, planer, L. H. Ginn 882,943
Churn, H. James 883,027
Churn and butter worker, combined, Christensen & Solbeck 882,745
Chute attachment for windows, C. R. Young 882,605
Cider press, O. G. Haley 882,754
Cigar and cigarette holder, I. A. Heald ... 882,825
Cigar machines, wrapper smoothing mechanism for, Luckeft & Fogde 882,703
Cigars and the like, forming hygienic metallic ends on. A. A. Van der Meulen 882,770
Cigars, pressing, R. Woerner 883,156
Cigarette machine, paper strip controlling and printing mechanism for, S. I. Prescott 882,651
Cleaning tool, pneumatic, C. Moukos 882,574
Clevis, plow, C. C. Rankin 882,797
Clip, Horton & Molesworth 882,886
Clip, W. F. Oakley 883,119
Clock, graphophone, C. W. Henrich 883,111
Cloth, G. Moss 882,832
Clothes drier, M. P. Peterson 882,960
Clothes drier, W. Scully 883,053
Clothes pin, A. Stratton 883,060
Clothes pressing machine, J. B. Replogle ... 882,841
Clutch, T. B. Rice, Jr. 882,911
Clutch, friction, A. Kingsbury 882,693
Clutch, magnetic, R. Anderson 882,607
Coal and rock drill, H. R. Ford 882,878
Coal pocket gate, A. Suck 882,804
Cock, gage, T. R. Whittaker 883,066
Coffee pot, H. A. Pike 882,712
Collars, stiffening cape for coat, J. W. Gray 882,674
Commutator for polyphase currents, A. Heyland 882,682
Concrete mixer, J. D. Luttrell 882,830
Conduit construction, W. P. Day 883,092
Conduit joint, flexible, M. P. McLaughlin.. 882,836
Control system, electrical, H. D. James .. 882,687
Controlling switch, H. E. White 882,602
Convertible and interchangeable seat, Scullin & Skov 882,653
Conveyer, J. T. H. Paul 882,795
Copy holder, C. F. Ludington 882,903
Corking machine, F. Barthold 882,612, 882,663
Corn sheller, J. V. Stradley 882,723
Corset and corselet, combined, R. A. Whitehouse 883,125
Cotton chopper, R. Henry 882,757
Cotton chopper and cultivator, combined, G. W. Sharp 882,971
Cotton gin rib, T. A. Andrews 882,732
Crate, E. N. Davis 883,002
Crate, sectional hog and poultry, C. E. Knight 882,893
Crates, manufacture of, W. C. Yeomans .. 883,070
Crayon holder, M. M. Gee 883,009
Cultivator, W. L. Paul 882,957
Cultivator and planter, combined, Enns & Wiebe 883,006
Cultivator attachment, cotton, A. H. Connell 882,667
Current motor, J. Kirschweng 882,694
Current regulator, alternating, A. R. Everest 883,007
Curtain and pole holder, G. Walker 882,853
Cut-off, automatic, W. P. Norris 882,956
Cycles, two-speed driving gear and free-wheel mechanism for, E. Sachs 882,845
Deck plate, W. H. Durkee 882,877
Decorticating apparatus, Mitchell & Tomlyll 882,766
Decoy, folding, E. R. Rosentreter 883,161
Dental appliance, C. C. Galloway 883,106
Dental impression tray, H. F. Smith 883,055
Dental instrument, W. B. Pearsall 882,711
Derailment guard, F. Gehricke 883,107
Detector or feeler point, E. A. Bostrom ... 882,992
Distilling apparatus, wood, W. Danner .. 883,091
Ditching wheel, A. C. Heck 883,017
Door check, J. Soss 882,721
Door lock, D. H. Burtch 883,158
Drawing press, H. J. Hinde 883,021
Drill arm, radial, H. M. Norris 883,118
Drill boot, W. Houck 883,023
Drill head and cutter blade therefor, J. P. Karns 883,137
Driving mechanism, variable speed, R. M. Ruck 882,968
Eccentric, shifting, Lentz & Bellens 883,031
Egg carton, H. W. Janicke 882,688
Electric apparatus, vapor, O. O. Kruh, 883,030, 883,114
Electric furnace, E. Appleby 882,733
Electric furnace, A. L. Marsh 882,788
Electric heater, E. M. Hewlett 882,564
Electric furnace, H. L. Hartenstein 883,110
Electric machine, dynamo, J. P. Nikonow. 883,043
Electrical distribution system, R. N. Chamberlain 882,872
Electrical protective apparatus, J. A. Kenny 882,892
Electrical recording instrument, L. T. Robinson 882,586
Electrical resistance, adjustable, F. O. Ball 882,610
Electrically operated switch, H. F. Starrett 883,059
Electroplating apparatus, basket raising and lowering device for, W. R. King 882,783
Elevator retarding mechanism, A. J. Myer. 882,577
Embroidery hoop, G. H. Bixby 882,737
Engine igniting device, gas, J. V. Rice, Jr. 882,716
Engine starting device, internal combustion, F. H. Walker 882,597
Engine stop, V. J. King 883,029
Envelop, F. L. Richardson 882,843
Envelop fastener, H. F. Manley 883,035
Excavating apparatus, W. C. Weeks 882,726
Excavating machine, sectional conveyer frame for, A. C. Heck 883,016
Explosive engine, G. W. Gibbs, Jr 882,942
Explosive, safety, B. G. Reschke 882,910
Extension table, F. L. & L. B. Rivard 882,799
Extension table, P. Francis 882,865
Fabric, machine for applying strips of tape to, R. E. Dodge 882,779
Farming implement, M. Abbott 883,072
Fastener, A. M. Clark 882,996
Fastening, separable, C. C. Mund 882,708
Feeding device for draft animals, R. L. Smith 883,056
Ferrochromium, producing slag-free, J. B. Huffard 882,637
Filing cases, drawer support for, P. H. Yawman 883,069
Filter machine, H. W. Blaisdell 882,738
Fire alarm system, H. H. Hillier 882,758
Fire and water proof composition, G. Kelly, 882,890, 882,891
Fire escape, E. L. Flowers 883,104
Fire escape, balcony, C. J. A. Hanssen 882,677
Fire extinguisher, J. C. Shafer 883,149
Fire extinguishers, head for automatic, L. E. Fagan 882,629
Firearm, H. H. Talbot 882,594
Firearm, repeating, L. L. Hepburn, 882,561 to 882,563, 883,020
Firearms, target practice attachment for, J. M. Clark, 3d 882,551
Fireproof gravity sash, F. F. Smith 883,054
Fish hook, J. G. Henzel 882,882
Fishing reel, F. Dunning 883,100
Fishing tackle sinker, E. A. Pflueger 883,048
Floor surfacing machine, M. L. Schlueter. 882,847
Flooring tongue and groove joint, J. W. Piver 883,049
Fluid motor, C. Freborg 882,672
Flushing apparatus, street, Connelly & Schafer 882,626
Fly trap, W. D. Fuller 882,631
Flying machine, H. J. Cragun 883,090
Fodder and corn shock binder, F. M. Moss. 882,954
Fountain. See Mechanical fountain.
Frame for mirrors, brushes, pictures, and the like, R. R. Debacher 883,094
Furnace, Bluhm & Regan 882,616
Furnace, M. V. Smith 883,057
Furnace grate, J. J. O'Brien 882,794
Furnaces, stock distributer and gas seal for metallurgical, M. B. Parker 883,044
Furniture, W. J. Tingdahl 882,656
Furniture, combination, T. J. Young 882,772
Furniture spring, A. Weborg 882,600
Furrow maker and fertilizer distributer, combined, W. O. Cumming 883,000
Game apparatus, O. E. Hurst 882,945
Garment hanger, G. S. Stanton 882,592
Gas bracket, pendant, and the like, E. Schwerin 882,970
Gas burner, automatic, L. T. Burns 882,664
Gas engine, C. O. Carlson 882,812
Gas generator air forcing means, Campbell & Ringemann 882,994
Gas lighting and extinguishing mechanism, G. Robson 882,967
Gas, making, L. P. Lowe 882,764
Gas, manufacturing, H. M. Pierson, 882,908, 882,909
Gas manufacturing apparatus, H. M. Pierson 882,907
Gas producer, H. Gerdes 883,131
Gaseous mixture having disinfecting and extinguishing properties. apparatus for producing a, R. Marot 883,036
Gate, G. O. Kidder 882,692
Gate, O. H. Ahlemeier 882,987
Gate operating mechanism. H. E. Williams 882,984
Gearing, belt, rope, or chain, E. H. Hodgkinson 882,635
Gearing, friction, J. D. Baker 882,861
Glass, producing, E. Morenus 883,039
Glue applying machine, J. A. Butler et al. 883,082
Go-cart, O. Kurz 882,895
Golf practice apparatus, A. R. Sprague ... 883,058

STYLE
NEATNESS
COMFORT
THE IMPROVED
BOSTON
GARTER

The Name is stamped on every loop—Be sure it's there

THE Velvet Grip CUSHION BUTTON CLASP

LIES FLAT TO THE LEG—NEVER SLIPS, TEARS, NOR UNFASTENS

Worn All Over The World

Sample pair, Silk 50c., Cotton 25c. Mailed on receipt of price.

GEORGE FROST CO. Boston, Mass.

INSIST ON HAVING THE GENUINE
REFUSE ALL SUBSTITUTES

The American Speed Championship

NATIONAL BUSINESS SHOW

Chicago, Feb. 6, 1908,

Was Retained by the

UNDERWOOD STANDARD TYPEWRITER

The Winner, H. Otis Blaisdell, wrote 88 "net" words per minute for 30 minutes.

UNDERWOOD TYPEWRITER COMPANY

241 Broadway, New York.

THE Nulite Vapor GAS Lamps

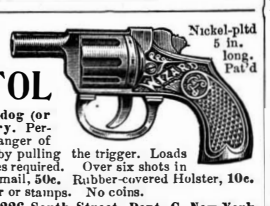
For Home, Store and Street

We also manufacture Table Lamps, Wall Lamps, Chandeliers, Street Lamps, Etc. 100 Candle Power seven hours ONE CENT. No Wicks. No Smoke. No Odor. Absolutely safe. THEY SELL AT SIGHT. Exclusive territory to good agents. Write for catalogue and prices.

Chicago Solar Light Co. Dept. G. Chicago

Wizard Repeating

LIQUID PISTOL

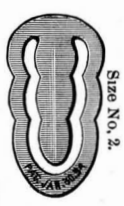


Will stop the most vicious dog (or man) without permanent injury. Perfectly safe to carry without danger of leakage. Fires and recharges by pulling the trigger. Loads from any Liquid. No cartridges required. Over six shots in one loading. All dealers, or by mail, 50c. Rubber-covered Holster, 10c. With Pistol, 55c. Money order or stamps. No coins.

PARKER, STEARNS & CO., 226 South Street, Dept. G, New York

THE EUREKA CLIP

The most useful article ever invented for the purpose. Indispensable to Lawyers, Editors, Students, Bankers, Insurance Companies and business men generally. Book marker and paper clip. Does not mutilate the paper. Can be used repeatedly. In boxes of 100 for 25c. To be had of all booksellers, stationers and notion dealers, or by mail on receipt of price. Sample card, by mail, free. Manufactured by Consolidated Safety Pin Co., Box 121, Bloomfield, N. J.



THE FREEMAN PIPE,

A Clean Smoke for Clean People

French Briar, Hard Rubber Bit straight or SMOKE PASSAGE bent. $1.00, postpaid.

ALWAYS CLEAN DRY & SANITARY

WRITE FOR BOOKLET.

FREEMAN PIPE CO., Dept. 18, Kalamazoo, Mich.

"Engineers' Descriptive Charts" In Colors Works of Art

By JOSEPH G. BRANCH, B. S., M. E.

Showing "The Development of The Steam Boiler."
"The Development of The Steam Engine."
"The Development of The Electric Generator."

Especially Designed for Colleges and Students. Price, 50c. each. Complete set, handsomely bound, $1.00.

"Conversations On Electricity," by Joseph G. Branch, . $2.00

"Heat and Light From Municipal and Other Waste," By Joseph G. Branch, $3.00

Agents Wanted. Sent prepaid on receipt of price.

Rand, McNally & Co., Publishers. New York & Chicago

Grain separator, J. A. Neufeld	882,955
Grainers, raking machine for, G. B. Willcox	882,727
Gramophone, L. T. Haile	883,135
Grapple, L. T. Pedigo	882,796
Grate, C. Pekat	883,046
Grate, oil, R. Held	882,634
Grate, sectional, Baker & Stein	882,860
Gravity lock, G. Yunker	882,921
Gun cleaner, O. P. Ward	882,598
Gun, trap, C. D. Lovelace	882,786
Guns, target and bullet catcher for use with air, W. Baker	883,077
Hammer, drop, W. T. Sears	882,588
Harmonica, reed, J. E. Murphy	882,575
Harness for horse training, H. Rasmussen	882,584
Harrow, disk, C. S. Sharp	882,589
Harvester, F. Rump	882,969
Harvester and binder tongue truck, J. Flaig	882,820
Harvester and husker, combined corn, J. L. Allender	883,073
Harvester and husker, corn, I. J. Ball	882,734
Harvester reel and actuating mechanism therefor, G. V. Ratz	882,715
Hat, washable, W. Neugass	882,648
Hay loader, C. E. Clugston	883,087
Headlight support, L. L. Lemay	892,898
Heater. See Electric heater.	
Heating furnace, air and water, C. A. Gibbs	882,558
Hides, treating, F. R. Wessa	883,124
Hinge for window screens, R. W. Carrington	882,813
Hog trap, E. H. Nelson	882,647
Hoisting apparatus, coal, J. Campbell	882,867
Hoof cutting knife, H. Andrews	882,662
Horses to and from vehicles, device for attaching and detaching, F. E. Griffeth	883,134
Hose clamp applier, D. Dubendorf	883,099
Hose coupling, T. N. Jones	882,690
Hosiery, J. W. Mettler	882,951
Hub with ball bearings, wheel, E. Sachs	882,846
Hydrant, C. J. Christensen	883,086
Hydraulic motor, B. F. Fowler	883,105
Hydrocarbon burner, G. W. Reed	882,585
Ice cream freezer, T. J. Fegley	882,936
Ice cream freezer, T. L. Valerius	883,064
Incubators and brooders, attachment for, W. E. Tredway	882,657
Indicator, H. F. Larava	882,897
Insecticide, H. C. Taylor	882,724
Insulator, L. W. Storror	882,803
Insulator strain, W. C. Terry	882,979
Jelly testing method and apparatus, J. Alexander	882,731
Lace fastener, shoe, M. B. Loller	882,701
Lacing, temporary shoe, J. W. Washburn et al.	882,919
Lamp, hydrocarbon, W. Tures	883,152
Lamp socket, plural, R. B. Benjamin, reissue	12,765, 12,766
Lamps, device for automatic kindling of incandescent, J. Danischevski	882,815
Last, A. G. Fitz	882,556
Last demonstrator, E. A. Eastman	882,818
Lead press, D. Carlin	882,742
Letter box alarm and indicator, Erickson & Bradshaw	882,752
Lifting jack, E. H. Z. Berge	882,991
Lightning arrester, W. T. Goddard	882,673
Liquid raising device, G. Waldmann	882,725
Lithopone and making the same, non-darkening, I. P. Lihme	883,142
Load holding device, A. L. Cox	882,746
Load moving apparatus, F. Koch	882,894
Loading apparatus, Miller & Dickinson	883,115
Lock, C. Jensen	882,566
Locomotive, G. A. Bothwell	882,618
Log dumping device, W. D. Link	883,032
Loom, H. Bardsley	882,922
Loom take-up mechanism, W. J. Lutton	882,904
Loom temple, C. L. Joy	822,827
Low water alarm, G. Woodall	882,807
Mail bag catcher, D. S. Green	882,559
Mail bag catching and delivering mechanism, W. H. Luker	883,033
Mail box, W. W. Palmer	882,709
Mail catching and delivering device, C. C. Andrews	882,661
Mail conveyer, F. E. Wolken	883,067
Manganese silicid, producing, E. F. Price	882,582
Manhole cover, H. Del Mar	883,096
Marine boiler, H. E. Penney	882,959
Match holder, lighter, and cigar cutter, J. Zander	882,729
Mattress making machine, D. Haynes	883,015
Mechanical fountain, N. P. Metrofanoff	883,038
Mechanical movement, G. A. Humpert	883,024
Melon carrier, W. A. Stark	882,722
Metal shaping tool, S. C. Bond	883,128
Milk cooler, H. C. Root	883,147
Mill stock mixer and distributer, F. C. Boynton	882,924 to 882,926
Molder's apparatus, S. Griffith	882,823
Molders, presser foot for irregular, J. C. Burchill	882,777
Molding apparatus, B. Horn	882,885
Molding machine for cutting panels, F. Sanders	883,148
Motor control, induction, K. A. Pauly	882,581
Motor control, induction, E. F. W. Alexanderson	882,606
Motor control, induction, electric, H. L. Van Valkenburg	882,658
Motor controller, electric, T. E. Barnum	883,078
Motor controlling system, electric, H. D. James	882,639
Motor frames, suspension device for, H. A. Knox	883,113
Motor starting device, M. J. S. A. Isnard	882,946
Moving device, G. Fleischmann	882,938
Mowing machine, H. P. Johnson	883,136
Music roll container, perforated, J. B. Gathright	882,557
Musical instrument, pneumatically operated, T. P. Brown	882,623
Musical instruments, key-striking mechanism for, F. L. Young	882,920
Nail pick-up device, E. Lahl	882,698
Nets, trip for hay, J. C. Calvert	883,083
Numbering machine, W. C. Downing	882,932
Nut lock, axle spindle, W. O. C. Ellis	883,102
Oil burner, O. B. Lyon	882,705
Organ, J. Binnig	882,736
Package tie, T. Boyd	882,863
Packing, shaft, G. Westinghouse	883,155
Paint and varnish remover and preparing the same, L. Kramer	882,947
Paint, fireproof, Apfel & Earnest	882,774
Painter's hook, F. L. Rand	882,965
Papers, liquid composition to be used in the manufacture of fancy stained, R. Schmiedel	882,916
Pasteurizing apparatus, E. J. Miller	882,706
Pencil box and book support, combined, A. Schlager	883,051
Photographer's light regulator, A. C. Novess	882,838
Photographic printing apparatus, A. C. Y. Macadam	882,571
Photographic printing apparatus, B. J. Hall	882,676
Piano keys, touch adjusting mechanism for, W. M. Clemans	882,814
Piano player treadle, automatic, Wright & Cummerford	883,068
Picture border, G. F. E. Pearsall	882,710
Pin. See Bonding pin.	
Pipe union, A. G. Anderson	883,075
Piston, Matheus & Hendee	882,572
Plant receptacle, electrical, H. S. Latshaw	882,699
Planter, W. B. Hampson	883,014
Planter, corn, C. W. Sparks	883,151
Plow, C. C. Rankin	882,839
Plow runner attachment, E. E. Edwards	882,751
Plow siding attachment, A. T. McIlwain	882,768
Pompadour roll, H. H. Taylor	882,655
Post, J. H. Doddridge	883,005
Poultry greaser, W. W. Wilson	882,985
Power transmission device, J. W. Lundgren	882,643
Printing machine, web, W. Scott	882,800
Printing publications, sheet to be used for, Brooks & Kinealy	883,157
Printing surfaces, machine for producing, Lyle & Owens	882,704
Projectile, submarine, T. Tucker	882,980
Pruning implement, W. H. Gerfin	882,781
Pump, J. Desmond	882,874
Radiator connection, R. C. Evarts	883,103
Radiators, steam trap and air vent for, C. B. Thompson	882,595

Keep Your Spark Plugs Clean

ZEROLENE, the non-carbonizing oil, ends all the troubles of carbon, frost and friction in gasoline engine lubrication. Gives perfect lubrication in any gasoline engine, regardless of type or temperature. This oil is produced in only one place.

ZEROLENE Auto-Lubricating OIL

leaves practically no carbon deposit, and "works" with absolute uniformity in zero weather or midsummer heat. Put up in sealed cans with patent spout that prevents can being refilled. Remember the label shown in cut, and the non-refilling feature which prevents substitution of inferior oils. ZEROLENE is also put up in barrels for the garage trade. Sold by dealers everywhere.

STANDARD OIL COMPANY
(Incorporated)

The Murray Vehicles

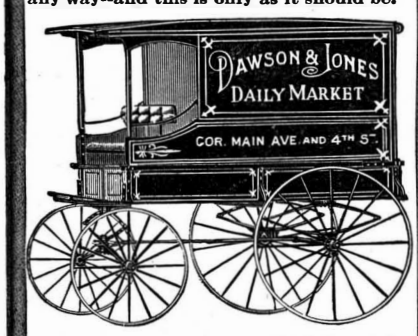
22 YEARS AT IT

Not too Costly—
Not too Cheap

Simply a combination of style, strength and durability—produced from the best grade of raw materials by craftsmen of the highest order—under the direction of the Murray regime—and sold at attractive prices.

A Murray Creation PRICE..... $63.00

Any responsible person can order and thoroughly test Murray Vehicles before paying one penny or obligating himself in any way--and this is only as it should be.



A Murray Creation PRICE..... $62.50

Illustrated Catalogue No. 17. which is free for the asking, shows our complete line of Buggies, Road Wagons, Stanhopes, Concords, Phætons, Traps, Surreys, Carriages, Pony Vehicles, Grocery Wagons, Laundry Wagons, Passenger Wagons, Farm Wagons, Busses, Harness and Saddles.

22 YEARS AT IT

WILBER H. MURRAY MANUFACTURING CO.,
Nos. 323, 325, 327 & 329 E. 5th St.
CINCINNATI, OHIO

The Largest Air-Cooled Motor Made

5 HORSE POWER

Bore 6 x 6 inches.

Plenty of cooling surface. No engine ever constructed with so few working parts.

Write for Agency.

Gasoline tank in base or outside.

Air-Cooled Motor Co.
Lansing, Mich.

"HOW TO REMEMBER"
Sent Free to Readers of this Publication

Stop Forgetting

You are no greater intellectually than your memory. Easy, inexpensive. Increases income; gives ready memory for faces, names, business details, studies, conversation; develops will, public speaking, personality. Send today for Free Booklet. Address

DICKSON MEMORY SCHOOL, 700 Auditorium Bldg., Chicago

THE BARKER MOTOR

has from the first shown itself to be of superior design. Mechanical ideas of proven worth, combined with the best materials and careful attention to details make it

THE LEADER OF ITS CLASS.

C. L. BARKER, NORWALK, CONN.

Do You Hear Well?

The Stolz Electrophone—a New, Scientific and Practical Invention for Those Who Are Deaf or Partially Deaf — May Now Be Tested in Your Own Home.

Deaf or partially deaf people may now make a month's trial of the Stolz Electrophone on payment of a small deposit. This is unusually important news for the deaf, for by this plan the *final* selection of the *one completely satisfactory hearing aid is made easy and inexpensive for everyone.*

Electrophone in use; shows less than Eye-Glasses.

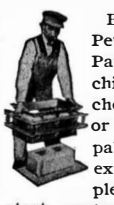
This new invention (U. S. Patents Nos. 858,986 and 865,458) renders unnecessary such clumsy, unsightly and frequently harmful devices as trumpets, horns, tubes, ear drums, fans, etc. It is a tiny electric telephone that fits on the ear and which, the instant it is applied *magnifies* the sound waves in such manner as to cause an *astonishing increase* in the *clearness of all sounds.* It overcomes the buzzing and roaring ear noises and, also, so *constantly* and *electrically exercises the vital parts of the ear that, usually, the natural unaided hearing itself is gradually restored.*

A Millionaire's Opinion

STOLZ ELECTROPHONE CO., Chicago —I am pleased to say that the Electrophone is very satisfactory. Being small in size and great in hearing qualities makes it *preferable to any.* I can recommend it to all persons who have defective hearing. M. W. HOYT, Wholesale Grocer, Michigan Ave and River St., Chicago. Write or call at our Chicago office for particulars of our *personal test* on deposit offer and list of prominent endorsers who will answer inquiries Physicians cordially invited to investigate. Address or call (call if you can)

Stolz Electrophone Co., 787 Stewart Bldg., Chicago
Branch Offices:—Philadelphia—Cincinnati—Seattle—Indianapolis—Des Moines—Toronto.

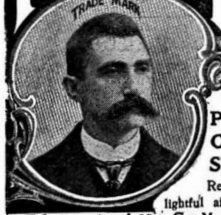
OWN A FACTORY



Big money making concrete blocks. Pettyjohn plants successful everywhere. Patented Portable and Collapsible Machine is the best, fastest, simplest and cheapest. No off-bearing. No cracked or broken blocks. No expensive iron pallets. Trade rapidly increases. No experience necessary. We furnish complete instructions. Now is the time to start. Write for full particulars.

The Pettyjohn Co., 615 N. 6th St., Terre Haute, Ind.

MENNEN'S BORATED TALCUM TOILET POWDER



A Positive Relief For PRICKLY HEAT, CHAFING, and SUNBURN, and all affections of the skin.

Removes all odor of perspiration. Delightful after Shaving. Sold everywhere, or mailed on receipt of 25c. Get Mennen's (the original). *Sample Free.*

GERHARD MENNEN COMPANY, Newark, N.J.

Instructive Scientific Papers

ON TIMELY TOPICS

Price 10 Cents each by mail

ARTIFICIAL STONE. By L. P. Ford. A paper of immense practical value to the architect and builder. SCIENTIFIC AMERICAN SUPPLEMENT 1500.

THE SHRINKAGE AND WARPING OF TIMBER. By Harold Busbridge. An excellent presentation of modern views; fully illustrated. SCIENTIFIC AMERICAN SUPPLEMENT 1500.

CONSTRUCTION OF AN INDICATING OR RECORDING TIN PLATE ANEROID BAROMETER. By N. Monroe Hopkins. Fully illustrated. SCIENTIFIC AMERICAN SUPPLEMENT 1500.

DIRECT-VISION SPECTROSCOPES. By T. H. Blakesley, M.A. An admirably written, instructive and copiously illustrated article. SCIENTIFIC AMERICAN SUPPLEMENT No. 1493.

HOME MADE DYNAMOS. SCIENTIFIC AMERICAN SUPPLEMENTS 161 and 600 contain excellent articles with full drawings.

PLATING DYNAMOS. SCIENTIFIC AMERICAN SUPPLEMENTS 720 and 793 describe their construction so clearly that any amateur can make them.

DYNAMO AND MOTOR COMBINED. Fully described and illustrated in SCIENTIFIC AMERICAN SUPPLEMENTS 844 and 865. The machines can be run either as dynamos or motors.

ELECTRICAL MOTORS. Their Construction at Home. SCIENTIFIC AMERICAN SUPPLEMENTS 759, 761, 767, 641.

Price 10 Cents each, by mail

Order through your newsdealer or from

MUNN & COMPANY
361 Broadway New York

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than ten lines accepted. Count seven words to the line. All orders must be accompanied by a remittance. Further information sent on request.

BUSINESS OPPORTUNITIES.

WANTED.—MAN; MUST BE WILLING TO LEARN AND CAPABLE OF ACTING AS OUR LOCAL REPRESENTATIVE. No canvassing or soliciting. Good income assured. Address National Co-Operative Realty Company, Department D. B. Z., Washington, D. C.

VENDING MACHINES FOR GUM AND SWEETS. Send for descriptive circular. Foreign rights for sale. For full particulars address S-D Machine Company, 465 Greenwich Street, New York City.

THE NEW ENGLISH PATENT LAWS.—A manufacturing firm with capitel is open to negotiate the working of Foreign Patents in England on Royalty Large connection amongst Railway and Steamship Companies. Royalty, Box 773, N. Y.

PATENTS FOR SALE.

IMPROVED TRENCHING HOE OR LAWN TRIMMER. U. S. Patent 871,565. On a royalty basis. E. B. Cahoon, 92 S. Balch Street, Akron, Ohio.

FOR SALE.

FOR SALE.—King Four Cylinder, Four Cycle Engines. Cylinders 5x5½-inch. Price $375. Northern Motor Car Co., Detroit, Mich.

FOR SALE CHEAP. Model Rotary Steam Engine, New. Apply Engineer, 57 Laight Street, New York.

HELP WANTED.

ARE YOU A CLEAN, Ambitious Salesman, Office or Technical man? Write for description of positions open. Salaries $700 to $5,000. Twelve offices. Hapgoods, 305 Broadway, New York.

AGENTS WANTED.

YOU CAN DECORATE China, Burnt Wood, anything, plain or in colors, from photographs. No talent required. A new art appeals to everybody. Cost small, profits enormous, decorating or teaching. Outfits supplied. Stamp for information and agent's prices. B. K. Vallance Co., Elkhart, Ind.

EDUCATIONAL.

LEARN TO MAKE PORTLAND CEMENT BLOCKS, white or any color: Waterproofing, Sidewalks, Bridge, Roof, Floor, Re-inforcements. Valuable Book. $1.00, Cement Institute, 806 Chestnut St. Louis, Mo.

AERONAUTICS.

INSTRUCTION.—Three courses; Balloons, Dirigibles, Aviation, prepared by Lieut. C. Espitallier, French Army. Catalogue. International School of Aeronautics, 2 East 29th Street, New York.

MALLET, Paris, Spherical Balloons and Dirigibles. Chauviere, Paris, Aeroplanes, Helicopteres. Antoinette Aviation Motors. Hue Aeronautical Scientific Instruments. Agent, A. C. Triaca, 2 East 29th St., N. Y.

BOOKS AND MAGAZINES.

ELECTRICIAN AND MECHANIC.—Practical monthly magazine for electrical and mechanical students and workers. Publishes illustrated directions for constructing dynamos, motors, gasoline engines, wireless telegraphy, electroplating, electrical wiring, mechanical drawing, using tools, furniture construction, boat building, all kinds of mechanical work. One dollar yearly; trial subscription for three months, twenty cents. List of electrical and mechanical books free. S. A. Sampson Pub. Co., 6 Beacon St., Boston, Mass.

HOUSEHOLD NEEDS.

BUTCHER'S BOSTON POLISH is the best finish made for floors and interior woodwork. Not brittle; will not scratch or deface like shellac or varnish. Send for free booklet. For sale by dealers in Paints, Hardware and House Furnishings. The Butcher Polish Co., 356 Atlantic Avenue, Boston, Mass.

PHOTOGRAPHY.

AMERICAN PHOTOGRAPHY succeeds American Amateur Photographer, Camera and Dark Room and Photo Beacon. The editors of each now join in making a magazine which should be in the hands of every photographer, professional or amateur. 15 cents monthly, $1.50 per year. Three specimen copies for a quarter. Am. Photographic Pub. Co., 361 Broadway, New York.

GRE-SOLVENT.

GRE-SOLVENT instantly dissolves Machine-grease, Paint, Ink, etc., from hands. Beneficial to skin. Sells like wildfire to every mechanic. Agents wanted. Big profits. Free sample. Do it now. Utility Co., 646 W. 44th St., N. Y. City.

OLD COINS AND STAMPS.

$5.75 PAID FOR Rare Date 1853 Quarters. Keep all money coined before 1875 and send 10c. at once for a set of two coin and stamp value books, size 4x7. It may mean your fortune. C. W. Clarke & Co., Le Roy, N. Y.

SPARK COILS

Their Construction Simply Explained

Scientific American Supplement 160 describes the making of a 1½-inch spark coil and condenser.

Scientific American Supplement 1514 tells you how to make a coil for gas-engine ignition.

Scientific American Supplement 1522 explains fully the construction of a jump-spark coil and condenser for gas-engine ignition.

Scientific American Supplement 1124 describes the construction of a 6-inch spark coil

Scientific American Supplement 1087 gives a full account of the making of an alternating current coil giving a 5-inch spark.

Scientific American Supplement 1527 describes a 4-inch spark coil and condenser.

Scientific American Supplement 1402 gives data for the construction of coils of a definite length of spark.

The above-mentioned set of seven papers will be supplied for 70 cents.

Any single copy will be mailed for 10 cts.

MUNN & COMPANY, Publishers

361 Broadway New York

Rail channels, set for tramway, F. O. Schneller	883,052
Rail joint, F. A. Collier	883,089
Rail joint castings, apparatus for molding, J. H. Allen	882,660
Railway safety indicator, Stankey & Christ	882,802
Railway semaphore, C. W. Coleman, 882,928 to	882,930
Railway signaling, C. M. Jacobs et al	883,026
Railway spike, E. R. Miner	882,953
Railway switching device, R. R. Miller	882,707
Railway tie, Phillips & Royer	882,906
Railway track, A. Rambacher	882,964
Railway track structure, J. O. Ulrich	883,063
Ratan canes, method of and apparatus for stripping weaving strips from, H. W. Temps	882,978
Razor, safety, E. M. Quint	882,963
Razor stropper, A. H. Fleming	882,630
Receipt, manifolding, Blake & Hunter	883,079
Refrigerator, L. Hall	882,824
Reservoir, T. J. Jackson	882,761
Resistance unit, L. E. Barringer	882,990
Rheostat, C. D. Knight	882,569
Rifle, magazine, J. J. Catron	882,625
Rifle sighting apparatus, Aloyos & Strohbach	882,988
Ring, D. F. Adams	882,810
Roasting furnace, mechanical, R. von Zelewski	882,730
Rotary engine, J. Murray	882,576
Rotary engine, W. M. Spencer	882,591
Rotary engine, J. A. Eaton	882,750
Rotary engine, J. F. Hopper	882,884
Rotary engine, R. Lundquist	883,034
Rug corner weight, P. B. Ammerman	882,859
Running gear, M. W. Heyenga	882,826
Sad iron handle, J. H. Cox	882,747
Safe, C. U. Carpenter	882,995
Safe and vault, burglar proof, W. Brinton	882,620
Safety pin, A. W. Straight	882,917
Sand blast, hand operated, H. Mikorey	882,645
Saw jointer, C. R. Pierce	882,961
Saw tooth, insertible, W. H. Askins	883,076
Scaffolds or stages, attachment for swinging, W. B. Stoops	882,769
Scraper and conveyer, combined, L. Arms	882,775
Screw eye driver, T. J. Feeley	882,937
Seal, car, H. C. Folger	882,670
Sealing cap, bottle, L. Kalling 882,888,	882,889
Sewer construction, A. J. Galvin 882,940,	882,941
Shaft coupling, Bommer & Robert	882,739
Shaft or journal box, H. E. Norbom	882,579
Sharpener, scissors, M. Henry	883,019
Shaving cup, C. M. Davis	882,668
Sheet metal gutter, S. D. Shoemaker	882,801
Shelf, G. W. Curtis	883,001
Shelter shed, F. O. Cary	882,870
Shock gatherer, Ereckson & Jystad	882,819
Shoulder brace, W. M. Eisen	883,101
Shovel and scoop, B. Zimmel	883,071
Sign, E. B. Wolfe	882,857
Sign, electric, S. E. Doane	882,555
Sign or the like, advertising, S. Krotoschin	882,949
Signal, F. B. Corey	882,554
Signaling device, S. C. Cart	882,744
Skate, roller, T. J. Hruby	882,782
Skate, roller, Copenhaver & Colvin	882,999
Sled, T. B. Poindexter	883,050
Smoke consumer, Moran & Donohue	882,767
Smoke filtering attachment for pipes, etc., C. W. Rowe	882,913
Smoke house, E. T. Malloy	882,787
Snap switch, Scott & Wyatt	882,848
Sound muffler, J. F. & H. M. Hirsh	882,684
Sound reproducing devices, hearing tube for, G. A. Lewis	882,700
Spark timing apparatus, C. C. Dodge	882,876
Speed transmitting mechanism, variable, A. J. Meyer	882,952
Spinning and twisting apparatus, ring, T. C. Powell	883,120
Spinning apparatus, traverse motion for yarn, J. Northrop	882,793
Spinning frames, drawing roll cleaner for, Deeley & Ollendorff	882,931
Spout, flexible, J. H. Gilman	883,109
Spraying apparatus, color, H. Mikorey	883,144
Spring structure, W. R. Smith	882,654
Square, try, J. F. McCurdy	883,041
Stamp mill guide block, W. T. Byng	882,624
Stannic-chlorid solutions, electrolyzing aqueous, Von Kugelgen & Seward 883,140,	883,141
Steam boiler, oil burning, C. A. Hammel	882,756
Steam generator, H. Del Mar	883,095
Steel tank, O. K. Harry	882,678
Steering device for power boats, J. A. Garrett	882,821
Still, water, A. R. Bailey	882,811
Stirrup, safety, J. M. Hibbard	882,683
Stocking, E. H. McColloch	882,834
Stocking cap, L. M. & H. E. Mills	882,789
Stone drilling machine, Weiss & Nagel	882,805
Stone, manufacturing artificial, J. Staudt	882,975
Storage battery, W. L. Merrin	882,573
Stove, S. Boal	882,617
Street sweeper, J. Nelson	882,578
Stuffing box, F. M. Beamer	882,613
Suit cases, etc., fastening for handles of, F. H. White	882,601
Sustaining and propelling mechanism, D. B. Littlefield	882,899
Switch actuating mechanism, electric, H. B. Snell	883,150
Switch stand, W. W. Allen	883,074
Syringe, T. H. Wallis	883,153
Talking machine, T. Kraemer	882,785
Telegraph and telephone pole seat, lineman's portable, C. T. Troell	882,850
Telegraph keys, strain relieving attachment for, W. H. Teachworth	883,062
Telegraph poles, device for attaching crossarms to, J. E. McGillivray	882,835
Telephone instrument, C. E. Cole	883,088
Telephone system, divided central, W. W. Dean	883,093
Telescope, panoramic, H. Jacob	882,762
Temperature, means for showing from a distance the variations in, J. B. Fournier	883,159
Tent, folding, W. R. Diehl	882,875
Textile industry, torrefying apparatus for the, C. F. Kaisser	882,691
Thermostat, C. J. Fox	883,008
Thill coupling, J. S. Shoemaker	882,972
Thill support, A. W. Perry	882,650
Thread guide, I. E. Palmer, reissue	12,769
Thresher, traveling, R. Sylvester	882,977
Threshing machine, G. Klein	882,763
Threshing machine, F. F. Landis	882,896
Ticket holder, E. Z. Wilkoshesky	882,771
Tile, roofing, M. Marte	882,765
Tin cleaning and polishing machine, B. H. Divine	883,098
Tin, cyclic process of recovering metallic, Von Kugelgen & Seward	883,139
Tire, pneumatic, E. A. Marsh	882,905
Toe weight, M. Norton	882,837
Toothpick boxing machine, C. C. Freeman	882,879
Torpedo steering apparatus, A. J. Van Stockum	882,982
Torpedoes, means for actuating submersion rudders for, A. E. Jones	883,028
Toy, W. T. Wood	882,604
Toy engine, electromagnetic, Hawekotte & Klausmann	882,681
Trace carrier, W. E. Dippert	883,097
Traction wheel, A. E. Glascock	883,010
Transporting apparatus, A. Suess	882,976
Trolley, H. C. Reynolds	882,966
Trolley harp, F. M. Mudler	882,833
Trolley wheel, D. D. Grant	882,753
Trolley wheel and sleet cutter, combined, E. M. Schollenberger	882,717
Truck, electrically operated baggage, T. V. Buckwalter, reissue	12,767
Truck, railway car, M. Kennedy	882,642
Truck side frame, car, A. Lipschutz	883,143
Truck, warehouse, R. S. Bergsather	882,735
Turning irregular objects, machine for, F. Hanses	882,632
Typewriter adding attachment, H. H. Burton	883,081
Typewriter carriage shifting mechanism, W. P. Kidder	882,828
Typewriter type bars, hanger for, C. F. Crandall	882,627
Typewriting machine, A. T. Brown	882,993
Typewriting machine ribbon reversing mechanism, W. P. Kidder	882,829

RADIUM STORAGE BATTERIES

WITH OR WITHOUT INDICATORS

Indicator removes all doubt as to working condition of your battery. No Automobile is properly equipped without it. No more Ignition Troubles. Simple construction, positive in action. Can be used for Lighting and hundreds of other purposes, in fact wherever a small source of electrical power is required. Write for valuable booklet, facts and Price List.

GENERAL ACCUMULATOR AND BATTERY CO., 128 Second Street, MILWAUKEE, WIS.

THAT DAINTY MINT COVERED CANDY COATED CHEWING GUM

Chiclets

REALLY DELIGHTFUL

At All the Better kind of Stores 5 cents the Ounce or in 5¢. 10¢. and 25¢. Packets

If your neighborhood store can't supply you send us 10c for sample packet.

FRANK H. FLEER & COMPANY, INC., Philadelphia, U. S. A., and Toronto, Can.

"Columbus"

THE BUGGY OF QUALITY

NOW SOLD DIRECT TO CONSUMER

FROM FACTORY AT FACTORY PRICES

COLUMBUS QUALITY ONLY $52.50

COLUMBUS BUGGIES

BUILT BY US

The Standard for Quality Everywhere

NOW SOLD DIRECT FROM OUR FACTORY TO YOU SAVING YOU THE HOME DEALER'S PROFIT

A "Columbus" is the vehicle you should buy. Don't take chances when you can go direct to the manufacturer, getting the genuine *Columbus Quality* and *Columbus Style, saving the 40% to 60% Dealer's Profit.*

Every Vehicle Sold on One Full Month Approval Trial and Guaranteed Two Years.

We want you as a customer—once a *Columbus customer*—always a *Columbus buyer.* When you do business with this company, you are dealing with an old reliable manufacturer with a reputation built on quality and square dealing. We have buggies now in use sold over 15 years ago. We have thousands of customers who would not have anything else.

FREE OUR CATALOGUE of COLUMBUS BUGGIES, Runabouts, Phaetons, Surreys, Stanhopes, Carriages and Harness will be mailed to you *absolutely free.* Write for it now.

THE COLUMBUS CARRIAGE & HARNESS CO., 2063 So. High Street, Columbus, Ohio

The New Nationals

Touring Cars, Roadsters, and Limousines

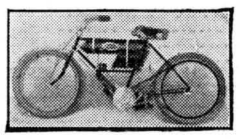
meet every requirement of the experienced purchaser in **accessibility, simplicity of construction, ease of operation; are quiet,** and have **ample power.** The **National** has **a ball-bearing motor, aluminum body, two complete ignition systems, perfect spring suspension,** and contains everything that has **proven best in modern motor car construction.**

Model K—4 cyl., 4⅞x5. Model R—6 cyl., 4½x4¾.
Model N—4 cyl., 5x5. Model T—6 cyl., 5x5.

Write for particulars and our booklet, "What Owners Say About Their Nationals."

National Motor Vehicle Co., 1019 E. 22nd St., Indianapolis, Ind.

METAL POLISHES.—FORMULAS FOR Putz Pomades, Pastes, Liquids, Powders and Soaps for polishing metals, are contained in SCIENTIFIC AMERICAN SUPPLEMENT Nos. 1283, 1288 and 1289. Price 10 cents each from this office and all newsdealers



THE AUTO-BI

A powerful, speedy motorcycle so simply constructed any one can handle it with ease, comfort and safety. Strictly high grade.

Price $185.00 to $210.00, Agents wanted everywhere.

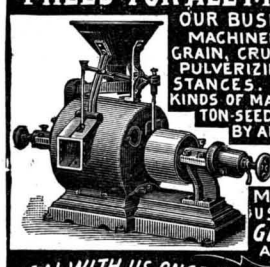
BUILD YOUR OWN MOTORCYCLE

We also manufacture a high grade, high powered motor set. Write for terms and catalogue

THE AUTO-BI COMPANY

1450 NIAGARA ST. BUFFALO, N. Y.

MILLS FOR ALL MATERIALS.



OUR BUSINESS IS TO MAKE MACHINERY FOR GRINDING GRAIN, CRUSHING ROCKS AND PULVERIZING ALL HARD SUBSTANCES. WE HANDLE ALL KINDS OF MATERIALS FROM COTTON-SEED TO ROOTS AND HERBS, BY AN UNEXCELLED PROCESS. IF YOU WANT ANY KIND OF A MILL OR GRINDING MACHINE, COME TO US AND YOU WILL GET THE BEST AND STILL SAVE MONEY.

DEAL WITH US ONCE AND YOU WONT CHANGE.

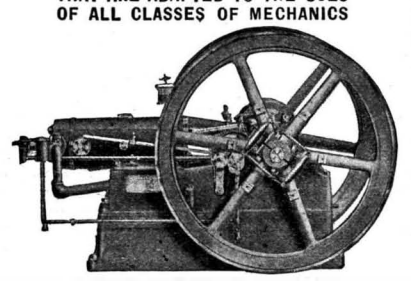
ESTIMATES FREELY FURNISHED.

SPROUT, WALDRON & CO.

(SEND FOR CATALOG NO 4.) MUNCY, PA.

EFFICIENT POWERS

THAT ARE ADAPTED TO THE USES OF ALL CLASSES OF MECHANICS



I. H. C. GASOLINE ENGINES

are built on strong, simple lines. Accessibility of parts, perfect control and operating economy are distinguishing features. These characteristics make I. H. C. engines unexcelled general purpose engines for shop, mill or factory use. They will always develop the full rated horse power because they are tested at the factory and are not sent out until they deliver a large per cent in excess of their rating. Minimum fuel consumption is also insured by this factory test.

Verticals in 2 and 3-horse power.

Horizontals (Portable and Stationary) in 4, 6, 8, 10, 12, 15 and 20-horse power.

Air Cooled Engines in 1-horse power.

Stocks carried by I. H. C. local agents Call on them or write the Home Office for catalogs and particulars.

INTERNATIONAL HARVESTER COMPANY OF AMERICA (Incorporated)

15 Harvester Building, Chicago, Ill.

SKIPPER MARINE ENGINE

RUNS ON

Kerosene, Alcohol or Gasolene

SIMPLE, POWERFUL, SPEEDY.

Made in 3 Sizes. Guaranteed.

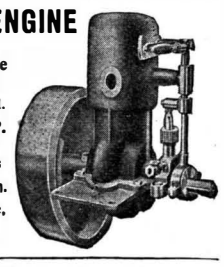
PRICE	2 H. P.	4 H. P.	6 H. P.
	$39	$64	$94

Complete, including boat fittings

Gray-Hawley Mfg. Co., Detroit, Mich.

Makers of the Gray Autochime, Mufflers, Valves, Whistles, etc.

SEND FOR CATALOG.



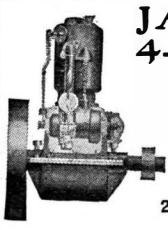
MEDAL OF HIGHEST AWARD

JAMESTOWN EXPOSITION

Add TONE to your Stationery in the OFFICE, BANK, SCHOOL or HOME by using only Washburne's Pat. **"O.K."** PAPER FASTENERS

There is genuine pleasure in their use as well as **Perfect Security.** Easily put on or taken off with the thumb and finger. Can be used repeatedly and *"they always work."* Made of brass, 3 sizes, in brass of 100 fasteners each. Send 10c for sample box of 50, assorted. Booklet free.

THE O.K. MFG. CO. Dept. X Syracuse, N.Y. No 18



JAGER Marine 4-Cycle Engines

Skillfully designed and well built. Single lever control, combining automatic carburettor with spark advance. Develops wide speed range and reliability under most trying conditions Sizes 3 to 60 h. p. Send for catalog.

CHAS. J. JAGER CO.

281 Franklin, cor. Batterymarch St. Boston, Mass.

I absolutely guarantee you will be satisfied. I will instantly refund your money if you are not. I stand back of every statement made in this advertisement. I have made them as strong and convincing as I know how. The goods warrant it.

C. C. Brooks

Build Your Own Boat

BY THE **BROOKS SYSTEM**

AND SAVE THREE-FOURTHS

I can sell you a boat for one-fourth of what a factory would charge, 100 cents worth of actual value and results for 25 cents.

My catalogue will prove what I claim. **Give me a chance**—right now, to-day.

Read my guarantee—it means you take no risk.

Seven years ago I originated the pattern system of boat-building.

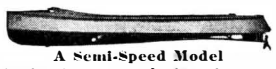
Over 50,000 boats (more than the combined output of all boat factories) have been built from my system, mostly by inexperienced men and boys.

Boat Patterns, $1.50 and Up

A Set-up Frame

Anyone can build a boat by using my exact size printed paper patterns and illustrated instruction sheets. You cannot fail to build as good a boat as the professional boat builder.

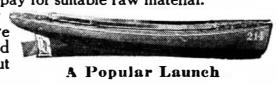
Knock-Down Boat Frames



A Semi-Speed Model

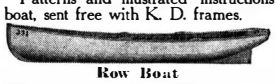
Many people prefer to buy my knock-down frames (all ready to put together) for their boats, instead of working up the rough lumber. I can in many cases supply knock-down frames at a lower price than you would pay for suitable raw material.

All parts of my knock-down frames are accurately shaped and machined, ready to put together.



A Popular Launch

Patterns and illustrated instructions needed to finish the boat, sent free with K. D. frames.



Row Boat

I can save you, (1) boat-builder's profit, (2) labor expense, (3) big selling expense, (4) seven-eighths the freight. You can figure this out yourself.

If engine is desired, I make a special combination price with knock-down frame.

Remember, my guarantee means just what it says. The boat you build will be satisfactory—I guarantee it. I take all the risk. Write me personally for my **Boat** or **Engine** Catalog, mailed free.

BROOKS BOAT MFG. CO.

C. C. BROOKS, Pres.

(Originators of the Pattern System of Boat-Building)

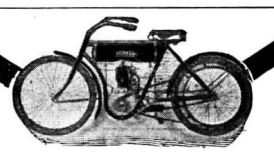
404 Ship Street, SAGINAW, MICH., U. S. A.

Make Your **BIKE** Into a **MOTORCYCLE**

Without altering the frame and at little cost by attaching the new 1908 **Erie 2½ H. P. Attachment.** This includes all parts so that any one can make a strong up-to-date machine that will climb steep hills. Sample sold at cost to introduce it. Send 4c. in stamps for **Attachment** Catalog S or Motorcycle Catalog C.

MOTORCYCLISTS send 15c. in stamps for book on the care of Motorcycles. State make of your machine for acc. prices.

Motorcycle Equipment Co., Hammondsport, N. Y.



With the Merkel Spring Frame Motorcycle All Roads are Smooth Roads, and Every Ride a Pleasure Ride

The 1908 MERKEL rides with an easy spring that makes motorcycling a keen enjoyment—glides along smoothly without jar or jolt. With its Spring Frame, Double Grip Control, and Ball Bearing Motor, which may be had with Magneto Ignition, it stands out pre-eminently as the foremost American Motorcycle.

Our booklet tells the story—send for it.

MERKEL MOTOR CO.
1128 26th Ave., Milwaukee, Wis.

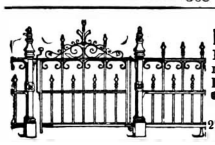
GOES LIKE SIXTY
SELLS LIKE SIXTY
SELLS FOR SIXTY

$60

GILSON GASOLENE ENGINE

For Pumping, Cream Separators, Churns, Wash Machines, etc. **FREE TRIAL** Ask for catalog—all sizes

GILSON MFG. CO. 308 Park St. Port Washington, Wis.



Iron and Wire Fences

Plain and heavy, also light and ornamental. Wire or Iron Fences. Highest grade at lowest prices. Write for catalog. **FREE.**

Enterprise Foundry & Fence Co., 272 S. Senate Ave., Indianapolis, Ind.

60 YEARS' EXPERIENCE

PATENTS

TRADE MARKS
DESIGNS
COPYRIGHTS &c.

Anyone sending a sketch and description may quickly ascertain our opinion free whether an invention is probably patentable. Communications strictly confidential. HANDBOOK on Patents sent free. Oldest agency for securing patents.

Patents taken through Munn & Co. receive *special notice*, without charge, in the

Scientific American.

A handsomely illustrated weekly. Largest circulation of any scientific journal. Terms, $3 a year; four months, $1. Sold by all newsdealers.

MUNN & Co. 361 Broadway, **New York**

Branch Office, 625 F St., Washington, D. C.

Union, H. E. Bullock	883,080
Union, J. R. Steneck	883,122
Upholstery pads, table for manufacturing, E. M. Hulse	882,685
Valve, Matthes & Rinehart	882,831
Valve, automatic shut-off, G. A. Fullipp	883,160
Valve, automatic stop, F. T. Reid	882,798
Valve, automatic time, A. A. Shingleton	883,121
Valve, bottle neck check, M. J. Brown	882,622
Valve, drainage, A. V. Knoll	882,784
Valve, dry pipe, L. E. Fagan	882,669
Valve, engineer's air brake, W. M. Austin	882,608
Valve, engineer's brake, W. V. Turner	882,596
Valve, fluid controlled flushing, R. A. Brooks	882,740
Valve for explosive engines, mixing, Fricke & Turner	882,939
Valve for sprinkler systems, emergency, C. A. Gray	882,822
Valve mechanism, W. B. Wade	883,123
Valve mechanism, pneumatic, Vrana & Schiba	883,065
Valve, triple, W. A. Weant	882,599
Valves and other uses, reversing device for engine, K. C. Hoxie	882,887
Vehicle brake apparatus, J. W. Taylor	883,061
Vehicle coupling, M. Turner	882,981
Vehicle reach, F. W. Bleckley	882,615
Vehicle top, B. H. Scheper	882,914
Vehicle wheel, road, J. Slee	882,718
Vehicle wheel, shock absorbing, H. R. Kumler	882,697
Vending machine, Bicker & Schilling	882,923
Vending machine, bottle, A. J. & I. B. Alexander	882,858
Vibrator, A. G. Gray	883,013
Violin, J. D. Loppentien	882,702
Wagon, chute, J. Campbell	882,869
Wagon, coal delivery, J. Campbell	882,868
Wagon or other vehicle, combination, T. Carroll	882,743
Waist lining, form fitting, H. J. Baer	882,989
Washing machine gearing, H. Brammer	882,619
Water closet flushing tanks, escape valve for, C. & E. G. Pfau	883,047
Water closet valve, P. Haas	882,944
Water cooler, H. G. Cordley	882,552
Watermelon carrier, C. A. Woodward	882,808
Waterways, apparatus for placing bed and bank coverings in, A. Casse	883,084
Wave motor, W. E. Hillson	882,883
Weather strip, C. D. Tabor	882,593
Weed cutter and cultivator, O. E. Slayton	882,973
Weight motor, J. C. Rackley	882,583
Well screen, water or oil, Childress & Cathriner	883,085
Wheel. See Ditching wheel.	
Wheel assembling machine, J. R. Welch	882,855
Wheel brake, vehicle, B. F. Hornsby	882,759
Wheel mud guard, vehicle, W. E. Drake	882,933
Whiffletree, G. F. Danielson	882,748
Winding machine, twine, C. P. Mitchell	883,116
Windmill, H. H. Macomber	882,644
Windmill, B. E. Cassell	882,871
Window, J. Emenaker	883,130
Window construction, metal, G. H. Forsyth	882,671
Window screen, F. Burckhardt	882,778
Wire feed and nail forming device, W. Wolfe	883,126
Wrapping machine, W. R. Williams	882,659
Wreck indicator, J. St. Antoine	882,974
Yarn, manufacturing, J. S. Butterworth	882,866

DESIGNS.

Automobile body, C. Schmidt	39,219
Bag fastening member, Hiering & Fuller	39,218
Bank, pocket, B. vom Eigen	39,217
Bottle, P. Garrett	39,215
Bottle, C. H. Hermann	39,216
Fabric, textile, E. Sims	39,223, 39,226
Plate or similar article, J. W. Pointon	39,214
Rug, W. A. Perry	39,221
Rug, F. A. Haas	39,222
Spoons, forks, and similar articles, handle for, T. B. Lasher	39,213
Wall covering, Wiggin & Cornelison	39,220

TRADE MARKS.

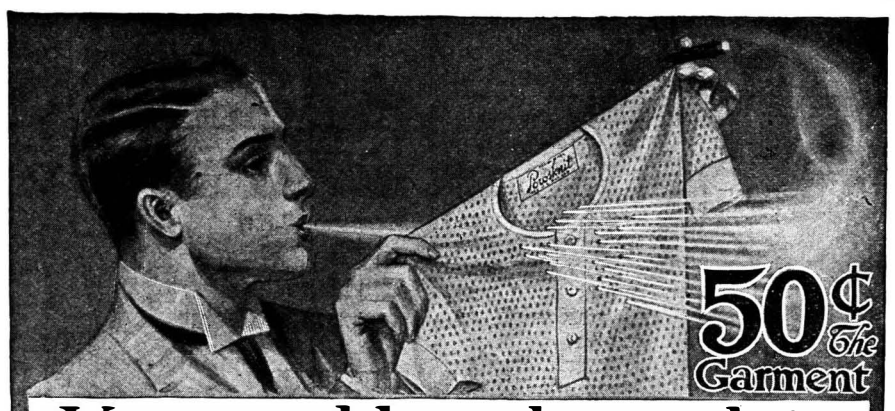
Alimentary preparation for infants and invalids, Chassaing & Cie	68,293
Birds, canary, Cugley & Mullen	68,290
Bolting cloth, silk, Schweizerische Seidengazefabrik A. G.	68,318
Boots and shoes, leather, Monroe Bros. & Co.	68,312
Candy, G. S. Feeny Co.	68,304
Chemicals, certain, A. von Isakovics	68,297, 68,298
Coal, Berwind White Coal Mining Co.	68,284
Cognac and cordials, Carmel Wine Co.	68,299, 68,300
Cotton piece goods, G. Willis & Co.	68,305, 68,308
Dishes, etc., porcelain, Porzellanfabrik Ph. Rosenthal & Co. Aktiengesellschaft	68,316
Firearms and parts thereof, certain, Birmingham Small Arms Co.	68,285
Fruit syrups, G. Finora	68,303
Grape juice, Paw Paw Grape Juice Co.	68,313
Incubators and brooders, United Incubator & Poultry Supply Manufacturing Co.	68,320
Knitted waists, J. F. Quinn	68,317
Lawns, Strawbridge & Clothier	68,319
Laxative, saline, Miller Bros.	68,311
Oils and greases, lubricating, Cook & Cokefair	68,302
Paper, safety, George La Monte & Son	68,291
Powder, and remedies for corns, foot, W. K. Peek	68,296
Rubber substitute, Corn Products Refining Co.	68,289
Sheetings and drillings, Pickens Mill	68,314
Sheetings and drillings, Piedmont Mfg. Co.	68,315
Soap, International Chemical Co.	68,309
Syrup and molasses, blended corn and cane, Florida-Georgia Syrup Co.	68,295
Syrup and molasses, sugar cane, Florida-Georgia Syrup Co.	68,294
Typewriting machines and parts thereof, Underwood Typewriter Co.	68,292
Water, mineral, Cold Spring Mineral Water Co.	68,301
Whisky, James Buchanan & Co.	68,310
Wines, Carmel Wine Co.	68,286, 68,288

LABELS.

"American," for pads and inks, J. A. Bearns, Jr., & Co.	14,111
"Apricot Cordial," for a liqueur, Chas. Jacquin et Cie., Inc	14,103
"Braid Filet Lace," for embroidered lace, Kursheed Manufacturing Co.	14,112
"Charcoal Chewing Gum," for charcoal chewing gum, J. L. Messer	14,108
"Coca Ginger," for a non-alcoholic beverage, A. D. Lewis	14,105
"Creme de Cacao," for a liqueur, Chas. Jacquin et Cie., Inc	14,104
"Food Laxative," for a medical preparation, Laxative Food Co.	14,110
"Jap-A-Ice," for an ointment, R. Reames	14,109
"R and R," for a liquor, Chas. Jacquin et Cie., Inc.	14,102
"Shackelford," for cigars, Schmidt & Co.	14,100
"Shamar Embroidery," for embroidered lace, Kursheedt Manufacturing Co.	14,113
"Sum-Mo," for cane-syrup and glucose, Columbia Coffee Mills, Ltd	14,107
"The Original Bermuda Milk Punch," for a milk punch, F. H. Tucker & Co.	14,106
"Town and Country, Real Turkish Cigarettes," for cigarettes, Wm. A. Stickney Cigar Co.	14,101

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.



50¢ The Garment

You can blow through it, But you can't wear through it.

Men who wear ***"Porosknit"*** Underwear don't suffer that "stifling" feeling and "sweaty" discomfort on hot days. It's the open knit texture of ***"Porosknit"*** Underwear that cools you off—that allows fresh air to reach the body and the perspiration and heat to escape.

It's the Logical Summer Underwear for Men

It's important that you buy and wear ***"Porosknit"*** Underwear for the following reason: The yarn used in ***"Porosknit"*** is from best long fiber stock and not from cheap, short stock, just one reason why they give satisfaction. If you don't find our trade-mark label on each garment, you haven't found the real thing.

"Porosknit" underwear comes in long sleeve, short sleeve and athletic shirts and ankle length and knee length drawers—at all dealers—**50c. the garment.**

"Porosknit" Union Suits for Men, $1.00. If you can't find ***"Porosknit"*** write for our booklet, "Inside Information."

CHALMERS KNITTING COMPANY, 21 Washington Street, Amsterdam, N. Y.

TRADE MARK **"Porosknit" UNDERWEAR** REG. U.S. PAT. OFF.

The Latest and Best **A. W. FABER "CASTELL" DRAWING PENCILS**

Made of the purest graphite in 16 degrees of hardness, **6B** to **8H**, of the utmost delicacy of tone, permanency, durability and intensity of color.

They take the finest point obtainable of any lead pencil, are least liable to wear, therefore more lasting than any others.

Sold by all stationers and dealers in artists' materials. **Sample sent** to all parties interested on receipt of 10 cents in postage stamps.

A. W. FABER, - - 49 Dickerson Street, Newark, New Jersey

LET US BE YOUR FACTORY
STAMPINGS, MODELS, EXPERT WORK
THE GLOBE MACHINE AND STAMPING CO.
970 Hamilton St., Cleveland, O.

ICE MACHINES Corliss Engines, Brewers' and Bottlers' Machinery. THE VILTER MFG. CO., 899 Clinton St., Milwaukee, Wis.

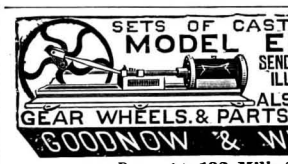
MODELS & EXPERIMENTAL WORK. Inventions developed. Special Machinery. E. V. BAILLARD. 24 Frankfort Street. New York.

RUBBER Expert Manufacturers Fine Jobbing Work
PARKER, STEARNS & CO., 228-229 South Street, New York

Experimental & Model Work
Cir. & advice free. Wm. Gardam & Son. 45-51 Rose St. N.Y.

ELECTRIC GOODS.—Big Cat. 3 cts. Want Agents. Ohio Electric Works, Cleveland, O.

MODELS CHICAGO MODEL WORKS ESTABLISHED 1867 179 E. MADISON ST. CHICAGO, ILL. WRITE FOR CATALOGUE OF MODEL SUPPLIES.



SETS OF CASTINGS OF MODEL ENGINES SEND 10¢ FOR 126 PAGE ILL. CATALOGUE. ALSO TOOLS, GEAR WHEELS & PARTS OF MODELS. GOODNOW & WIGHTMAN, BOSTON

Removed to **182 Milk Street.**

DIE WORK | SPECIAL TOOLS | MODELS NOVELTIES
Experimental Work for Inventors
H. TURNER TOOL CO., 215 S. Clinton St., Chicago

DRYING MACHINES For all kinds of granular materials. S. E. Worrell, Hannibal, Mo.

INVENTORS, MANUFACTURERS. LET US FIGURE ON SPECIAL TOOLS-DIES METAL SPECIALTIES. METAL NOVELTY WORKS CO. 85-91 W. LAKE ST. CHICAGO.

MASON'S NEW PAT. WHIP HOISTS
save expense and liability incident to Elevators.
Adopted by principal storehouses in New York & Boston
Manfd. by VOLNEY W. MASON & CO., Inc.
Providence, R. I., U. S. A.

THE SCHWERDTLE STAMP CO. STEEL STAMPS, LETTERS & FIGURES. BRIDGEPORT CONN.

METAL STAMPINGS
TOOLS, DIES and EXPERIMENTAL WORK
Well Equipped Factory for General Machine Work. Send sample or drawing for estimate.
Eastern Machine and Stamping Co. Providence, R. I.

NOVELTIES & PATENTED ARTICLES
MANUFACTURED BY CONTRACT. PUNCHING DIES, SPECIAL MACHINERY.
E. KONIGSLOW STAMPING & TOOL WORKS, CLEVELAND, O.

Magical Apparatus.
Grand Book Catalogue. Over 700 engravings 25c. Parlor Tricks Catalogue, free.
MARTINKA & CO., Mfrs., 493 Sixth Ave., New York

EXPERIENCED IN DEVELOPING INVENTIONS
Model Machine and Electrical Work
C. TIETZMANN, 198 Eleventh Avenue, Long Island City

INVENTORS We manufacture METAL SPECIALTIES of all kinds, to order; largest equipment; lowest prices. Send perfect sample for low estimate and best expert advice **FREE**
THE EAGLE TOOL CO., Dept. A, Cincinnati, O.

VENTRILOQUISM
Learned by any Man or Boy at home. Small cost. Send to-day 2-cent stamp for particulars and proof.
O. A. Smith, Room 694, 2040 Knoxville Ave., Peoria, Ill.

PANIC-PROOF FIRE ESCAPES For Schools, Theaters, Hospitals, Asylums, Factories, etc. Outside enclosed steel stairways. Short runs. Easy ascent. Continuous hand-rails. Greatest capacity. Strongest. Only escape on which quick fire drills can be held in absolute safety. **Particulars on request.**
BRAZIL FIRE ESCAPE CO., 616 Powers Building, Rochester, N. Y.

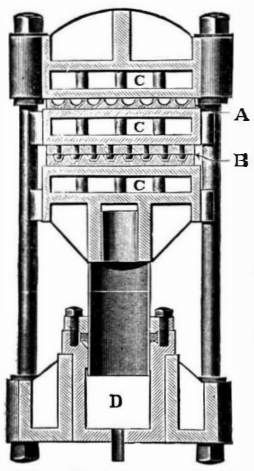
How to Construct An Independent Interrupter

In SCIENTIFIC AMERICAN SUPPLEMENT, **1615**, A. Frederick Collins describes fully and clearly with the help of good drawings how an independent multiple interrupter may be constructed for a large induction coil.

This article should be read in connection with Mr. Collins' article in SCIENTIFIC AMERICAN SUPPLEMENT, **1605**, **"How to Construct a 100-Mile Wireless Telegraph Outfit."**

Each Supplement costs 10 cents; 20 cents for the two. Order from your newsdealer or from

MUNN & CO., 361 Broadway, New York



We request manufacturers, inventors and others needing special articles in rubber to send us descriptions of their requirements with drawings or wood models for estimates as to cost of producing in rubber.

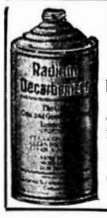
A full line of Mechanical Rubber Goods of every description.

Vulcanizing Press for Rubber Specialties

A Single Plate Mold. B Double Plate Mold. C Steam Spaces in Press Plates. D Hydraulic Pressure 2000 lbs. square inch.

NEW YORK BELTING & PACKING COMPANY, Ltd.
91 & 93 Chambers Street, New York

Scales All varieties at lowest prices. Best Railroad Track and Wagon or Stock Scales made. Also 1600 useful articles, including Safes, Sewing Machines, Bicycles, Tools, etc. Save Money. Lists Free. CHICAGO SCALE Co., Chicago, Ill.



DECARBONIZER

chemically removes carbon from cylinders, piston rings and valves.

INCREASES POWER 20 PER CENT

Volatilizes carbon, in which form it passes out thru exhaust. **Injury to metal impossible.** Agents wanted in certain localties, **Sample, quart can, $1.50.** Write to-day for particulars.

General Accumulator & Battery Co.
128 Second Street, Milwaukee, Wis.

LEARN TO BE A WATCHMAKER

Bradley Polytechnic Institute
Horological Department
Peoria, Illinois
Formerly Parsons Horological Inst.
Largest and Best Watch School in America

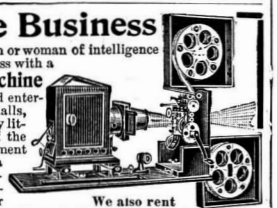
We teach Watch Work, Jewelry, Engraving, Clock Work, Optics. Tuition reasonable. Board and rooms near school at moderate rates. Send for Catalog of Information.

A Profitable Business

Any energetic, persistent man or woman of intelligence can establish a paying business with a

Moving Picture Machine

The investment is small and entertainments can be given in halls, schools, churches, etc., at very little expense. This is one of the most popular forms of amusement and a good machine assures a profitable business. We furnish full instructions—no experience is necessary. Our machines are reliable—prices right. Don't buy until you have had our free catalog.



We also rent films of all the latest subjects and sell all kinds of supplies.

Kleine Optical Co. 318 Butler Building 52 State St., CHICAGO

CRUDE ASBESTOS
DIRECT FROM MINES

PREPARED ASBESTOS FIBRE for Manufacturers use

R. H. MARTIN,
OFFICE, ST. PAUL BUILDING
220 B'way, New York.

Don't Throw Away Razor Blades

They can be resharpened in a moment with the

PRICE $2.00

Gaylor Automatic Stropper

In Case, with Genuine Horse Hide Strop, - $3.00
Automatic Stropper for Single Edge Blades, $1.00

Order through your dealer. Or will send postpaid on receipt of price. Be sure to state for what make of Blade. Write for descriptive circular.

L. B. GAYLOR, Alliston, Mass.

Build Your Own Small Engine

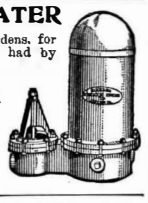
We sell sets of castings up to 2 horse power. Also boilers, locomotives, gas engines, etc. 32-page catalogue for 10c. in stamps. This amount refunded on order amounting to $1.00 or over. Contractors for light machinery of every description.

SIPP ELECTRIC AND MACHINE CO.
Keene St., Paterson, N. J.

PLENTY OF RUNNING WATER

for irrigating fields, sprinkling lawns and gardens, for use in the house and at the barn, can be had by installing a

Niagara Hydraulic Ram



Pumps day and night on any stream. Requires no repairs. Write for illustrated booklet AA and guaranteed estimate. We furnish towers and tanks

NIAGARA HYDRAULIC ENGINE CO.
140 Nassau St., N. Y. Factory, Chester, Pa.

GIANT STEAM SHOVELS

Toledo 125 Ohio, U.S.A. Vulcan Place

The Vulcan Iron Works Co.

IVER JOHNSON
TRUSS BRIDGE BICYCLE

Longer Life to the Wheel—Greater Comfort to the Rider

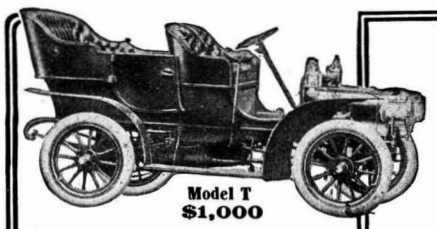
Iver Johnson Truss Bridge Racer $50
Roadster $40

Strength, Rigidity and Easy "Pushing"

The truss bridge makes a stronger and easier-riding bicycle, prevents "give" in the frame and keeps the running gear in alignment. Every part of the Iver Johnson Bicycle is made of the best material with the most skilled and accurate workmanship.

SEND FOR CATALOGUE giving illustrations, descriptions of all models, and name of your dealer

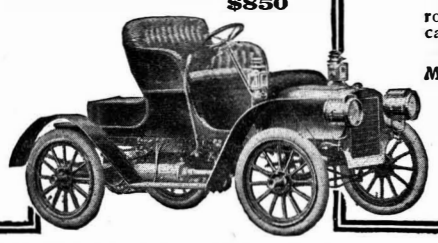
Iver Johnson's Arms & Cycle Works
170 River St., Fitchburg, Mass.
Manufacturers of Iver Johnson Revolvers ("Hammer the Hammer") and Single Barrel Shotguns.



Model T $1,000

The Single-Cylinder CADILLAC
Economy and Service

Model S-Runabout $850



FOR every dollar invested, including purchase price and maintenance, there are two to three times as many miles of actual service in a Single Cylinder Cadillac as in any other motor car.

This is not an empty claim. It is a fact borne out by the experiences of 16,000 users all over the world. Many of these have owned their Cadillacs for five years, have driven their cars 60,000 miles or more and are still using them.

No Cadillac, so far as we know, has ever been discarded because worn out or unfit for further service. If you want

The Truth about the Automobile and What it Costs to Maintain One

send for our Booklet No. 47 containing the *sworn* affidavits of a large number of users showing an average expense for repairs of cars of less than 50 cents per week and averaging more than 18 miles per gallon of gasoline under all road conditions—mud, sand, snow, hills, mountains.

The Single Cylinder Cadillac travels any road that is not entirely impassable and is capable of 30 miles per hour.

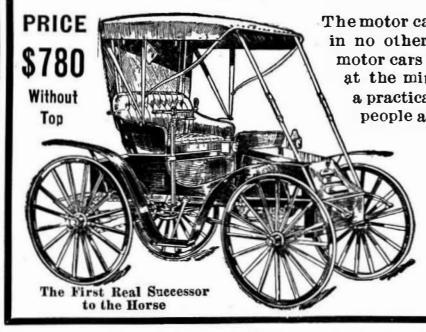
It is fully described in Catalog T 47. Mailed on request.

Prices include pair Dash Oil Lamps, Tail Lamp and Horn.

CADILLAC MOTOR CAR CO., Detroit, Mich.
Member A. L. A. M.

The Reliable Dayton Motor Car

PRICE $780 Without Top



The First Real Successor to the Horse

The motor car triumph of the day. Proved mechanical features found in no other car of carriage type. Expensive features of ordinary motor cars eliminated. Solid rubber tires. Gives maximum service at the minimum of cost. Any speed up to 25 miles an hour. It is a practical car for year-around service. A sensible car for sensible people and the first motor car to return a dollar's worth of service for every dollar of first cost and maintenance. Succeeds the horse; not the locomotive. Compare the Reliable Dayton point for point with other cars.

Catalog will be sent on request,

RELIABLE DAYTON MOTOR CAR CO.
Dept. 27, Chicago, Ill.

6c a Day Will Double the Efficiency of Your Bookkeeper or Clerks

and will give you quick and accurate results in the accounting, extending, costs, payroll, balances and statistics of your business.

The Comptometer

adds, multiplies, and divides rapidly, and without error by simply touching the keys. The Comptometer is as necessary in your business as a typewriter. It is the speediest, most durable, and most satisfactory mechanical calculator ever made. Follow your own good business judgment and let us prove this to you by our Special Trial Offer.

Write for pamphlet at once, and we will send you a booklet describing the Comptometer and its many uses. Comptometer sent, express prepaid, on trial to responsible parties in the U. S. or Canada. High-class salesmen wanted.

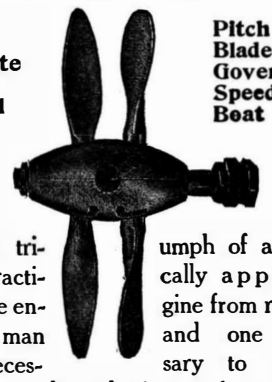
Felt & Tarrant Mfg. Co., W. Wabansia and Paulina Sts., Chicago.

Engineering News
(ILLUSTRATED)
214 Broadway, New York

The leading weekly Engineering paper of the world, devoted to the interests of Civil, Mechanical, Mining, and Electrical Engineers. 100 to 125 pages weekly. Send for free sample copy.

ROPER Safety Propeller

Gives Absolute Speed Control

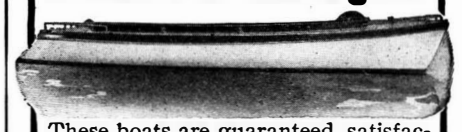


Pitch of Blades Governs Speed of Boat

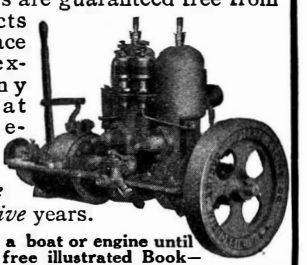
Scientific triumph of a new principle practically applied. Prevents the engine from racing. Only one man and one simple lever necessary to operate it. Responds to the instant, forward or back, fast or slow, or at any speed desired. Positively guaranteed to perform as represented. The closest, most critical and thorough investigation invited. Catalogue of complete information mailed upon request.

C. F. ROPER & CO., Hopedale, Mass.

Pierce Motor Boats and Engines



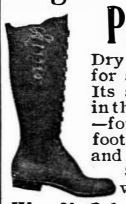
These boats are guaranteed satisfactory in every way. **Staunch and Safe,** they combine dependability and durability with lightness, speed and comfort. Equipped with **Pierce Noiseless Motors; the perfected result of 23 years experience** in building gasoline Motors. Both boats and motors are guaranteed free from all defects—we replace at **our** expense any part that proves defective—whether within *one* year or *five* years.



Don't buy a boat or engine until you get our free illustrated Book—you'll find it a reliable guide if you want to make a wise selection. Write today.

PIERCE ENGINE COMPANY, 24 West St., Racine, Wis.
1421 Michigan Avenue, Chicago
Siegel-Cooper, New York City Butler Motor Car Co., Boston

Engineers and Prospectors Protect Your Feet!



Dry and comfortable feet are essential for all those who work in the open air. Its all in the orthopedic cushion and in the waterproofing. Send today—now—for free catalogue. Everything in footwear for the sportsman, surveyor and engineer. Satisfaction guaranteed. Send 35 cents for 8 ounce can of waterproofing.

Wm. N Gokey Shoe Co., 19th St., Jamestown, N. Y.

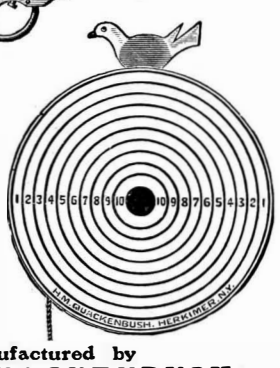
"THE ONLY ONE"

Here is the only double lip, self-centering countersink having a cutting keen edge and made on the true principle for a wood-working tool. It clears itself of shavings in any kind of wood and cuts a smooth, round hole. Made from the best steel, forged, twisted and tempered. Can be sharpened from the inside without a file. Prices, 5/8 in., 35c.; 3/4 in., 40c.

Send for 232-page catalog No. 18-B.

THE L. S. STARRETT CO., Athol, Mass., U. S. A

HIGH GRADE AIR GUNS, DARTS, SLUGS, STEEL TARGETS, 22–100 CAL. SAFETY RIFLES.



Manufactured by
H. M. QUACKENBUSH
Herkimer, N. Y.
SEND FOR CATALOGUE B

HELMET OIL LUBRICATES ANYTHING SEND FOR SAMPLE FREE 19-21 S. CLINTON ST.
C. H. BESLY & CO. CHICAGO, ILLINOIS, U.S.A.